APPENDIX A

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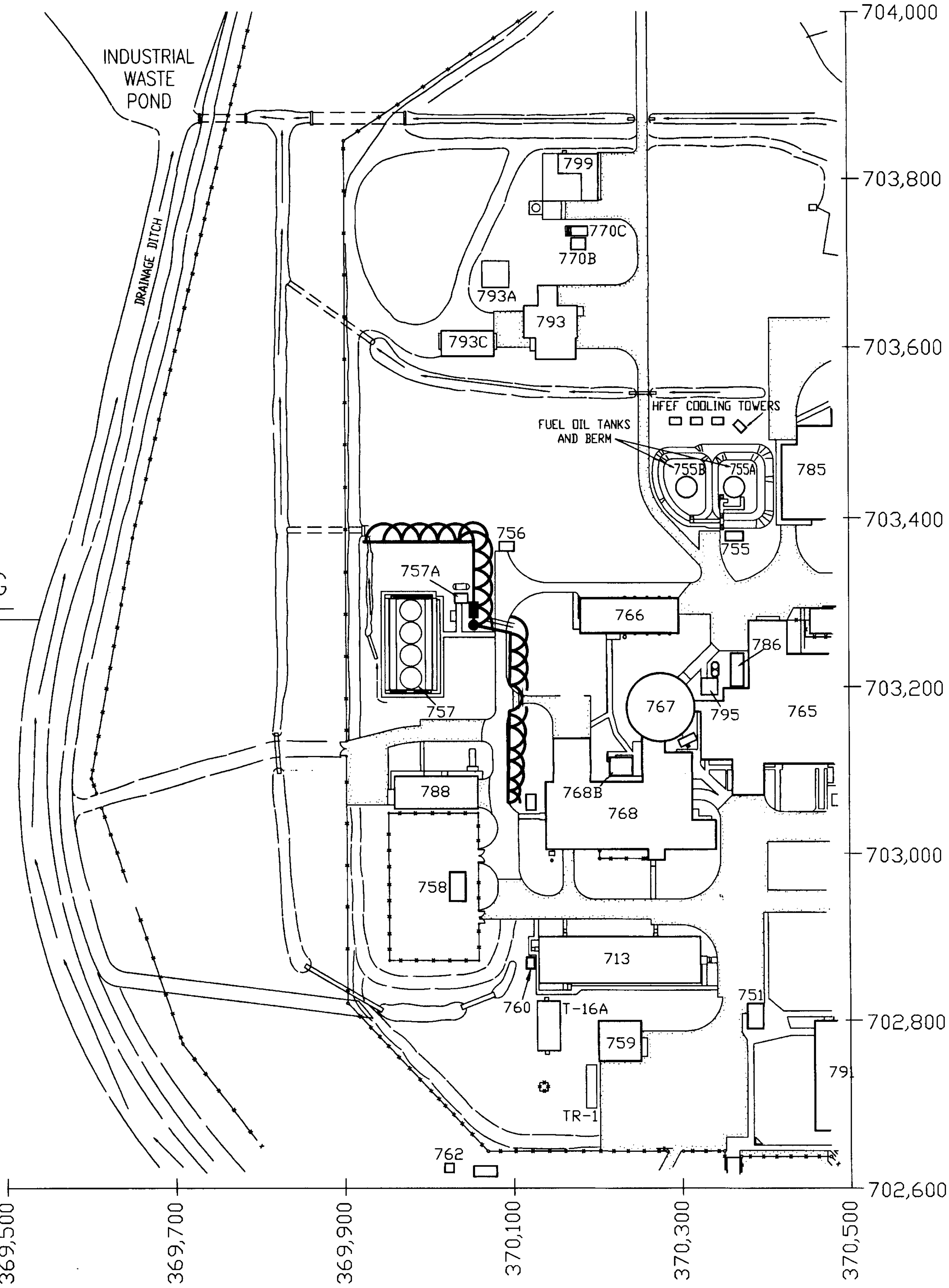
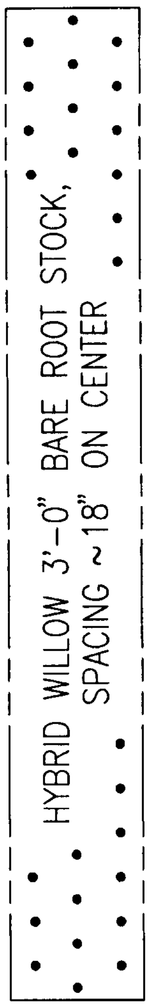
ARGONNE NATIONAL LABORATORY-WEST
SITE PLOT PLAN
OPERABLE UNIT 9-04
OF WAG-9
1994 SAMPLE LOCATIONS





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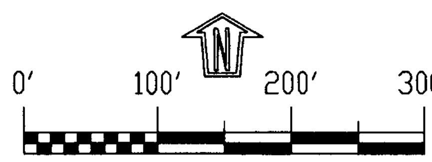

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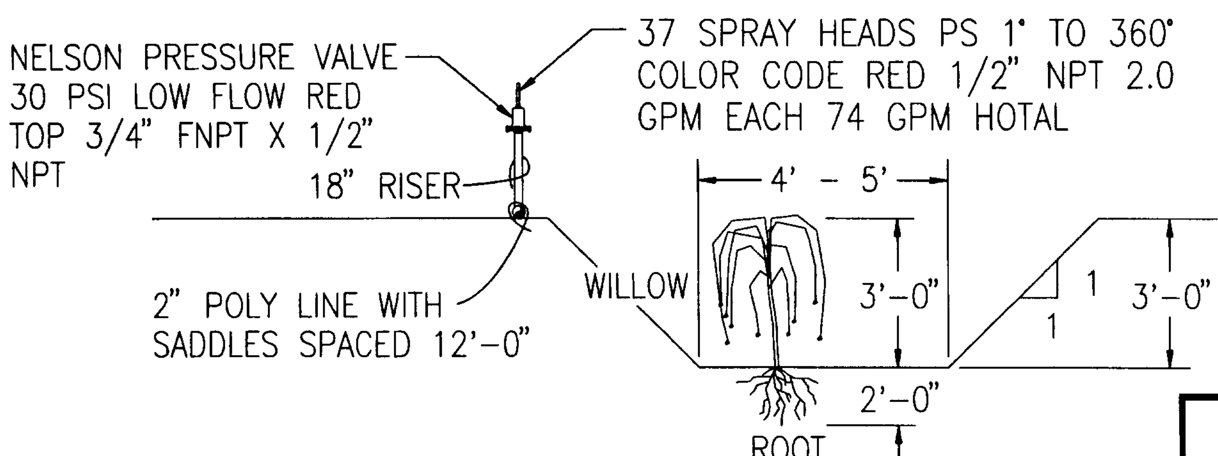

TYPICAL CROSS SECTION OF DITCH

SCALE: NONE

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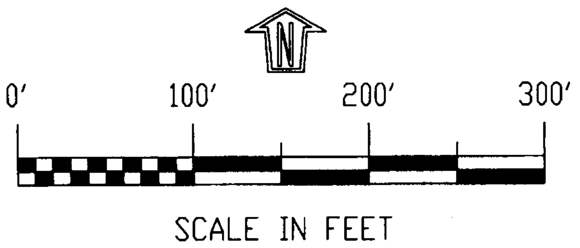
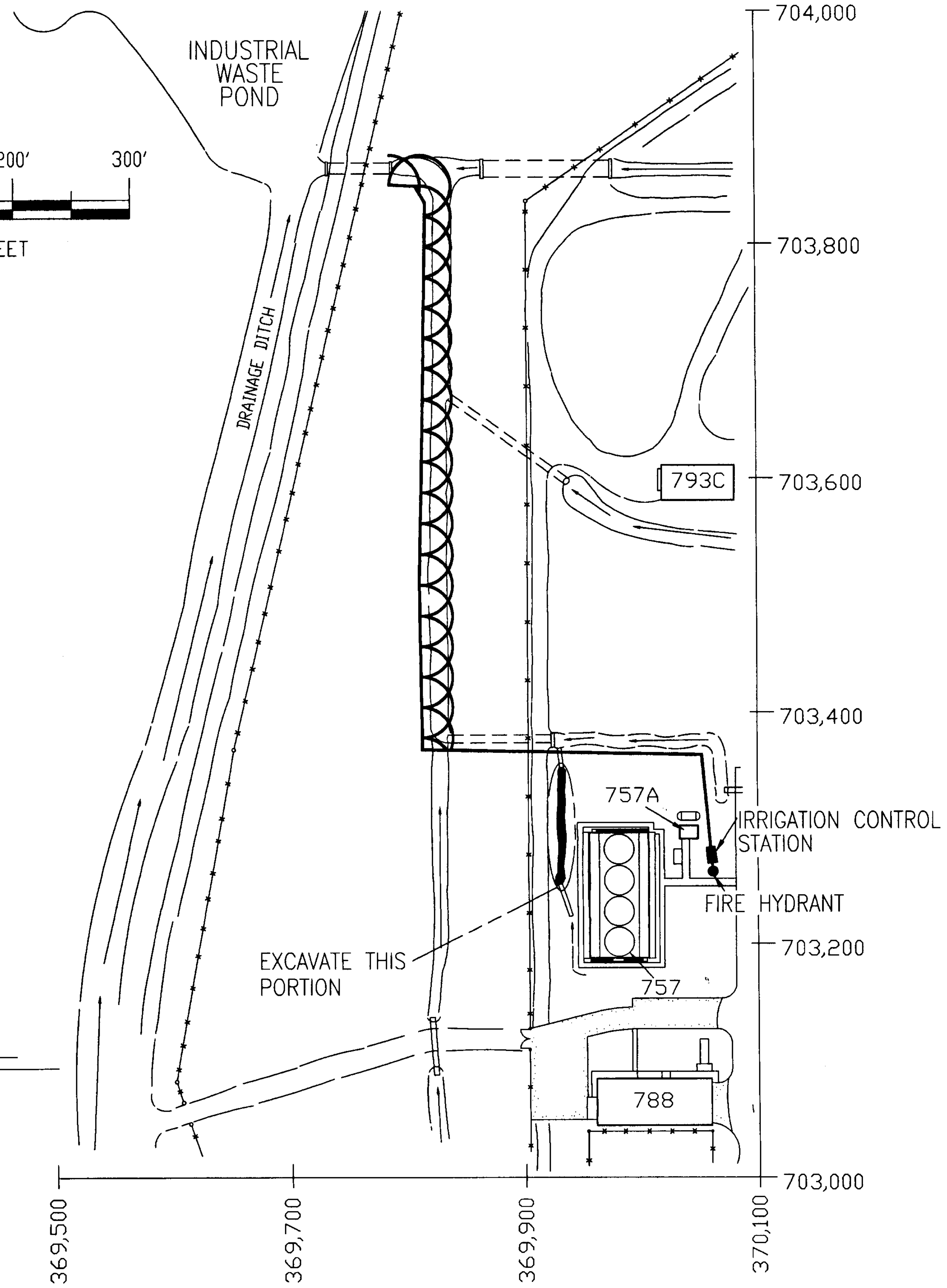
ARGONNE NATIONAL LABORATORY

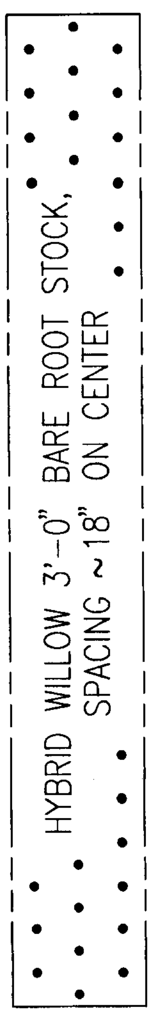
DITCH A

DRAWN BY	DATE	DWG NO
SHERRI L. PALMER	3-1-99	SITE-210.DWG

ARGONNE NATIONAL LABORATORY-WEST
ANL-01A
OPERABLE UNIT 9-04 OF WAG-9







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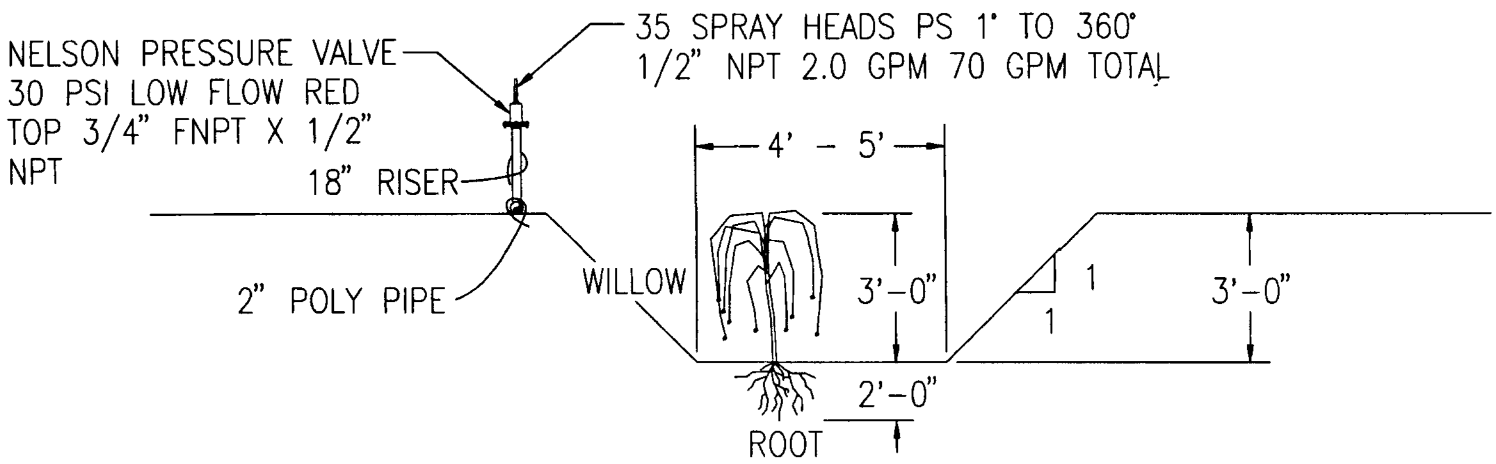

TYPICAL CROSS SECTION OF DITCH

SCALE: NONE

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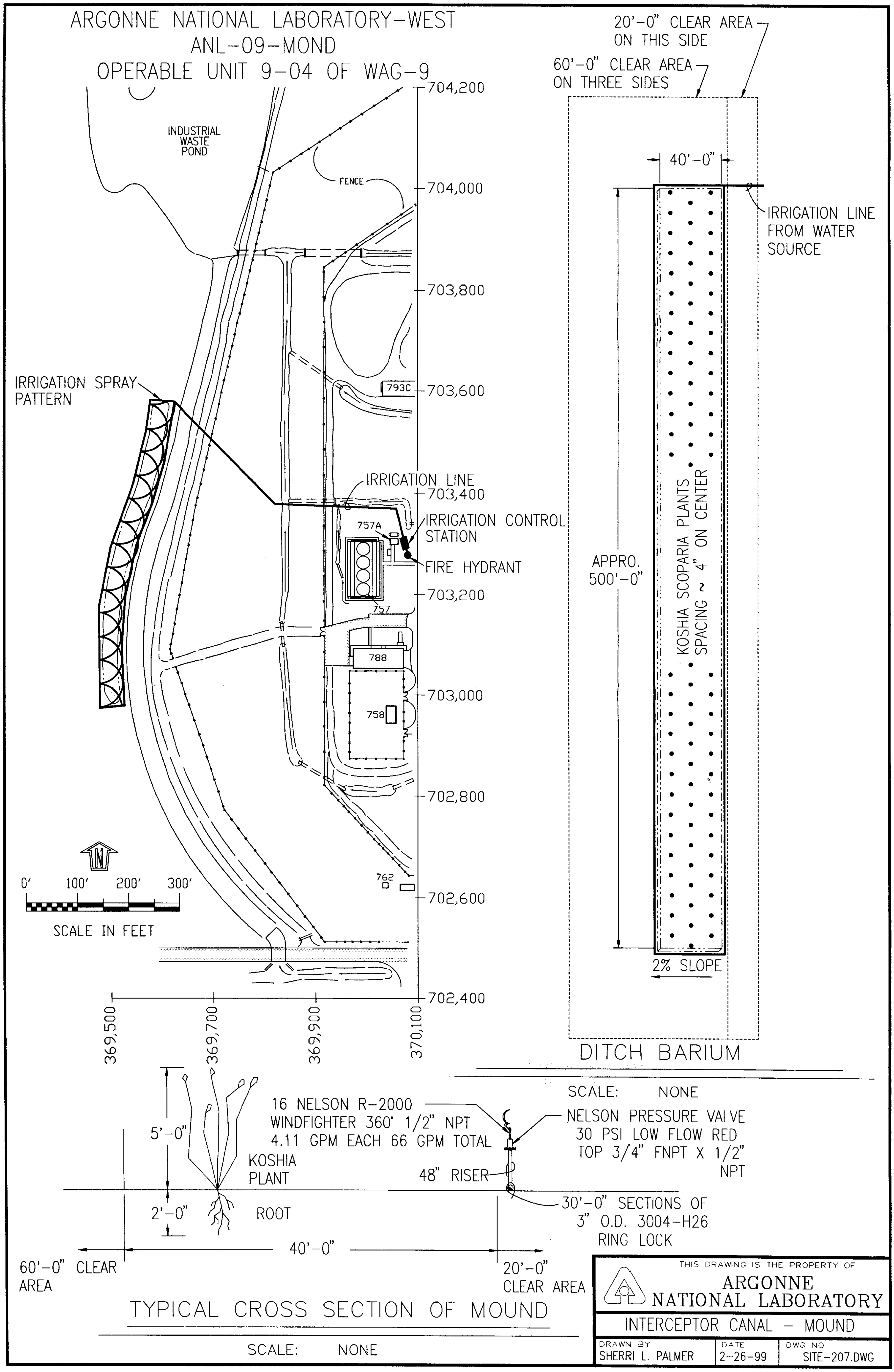
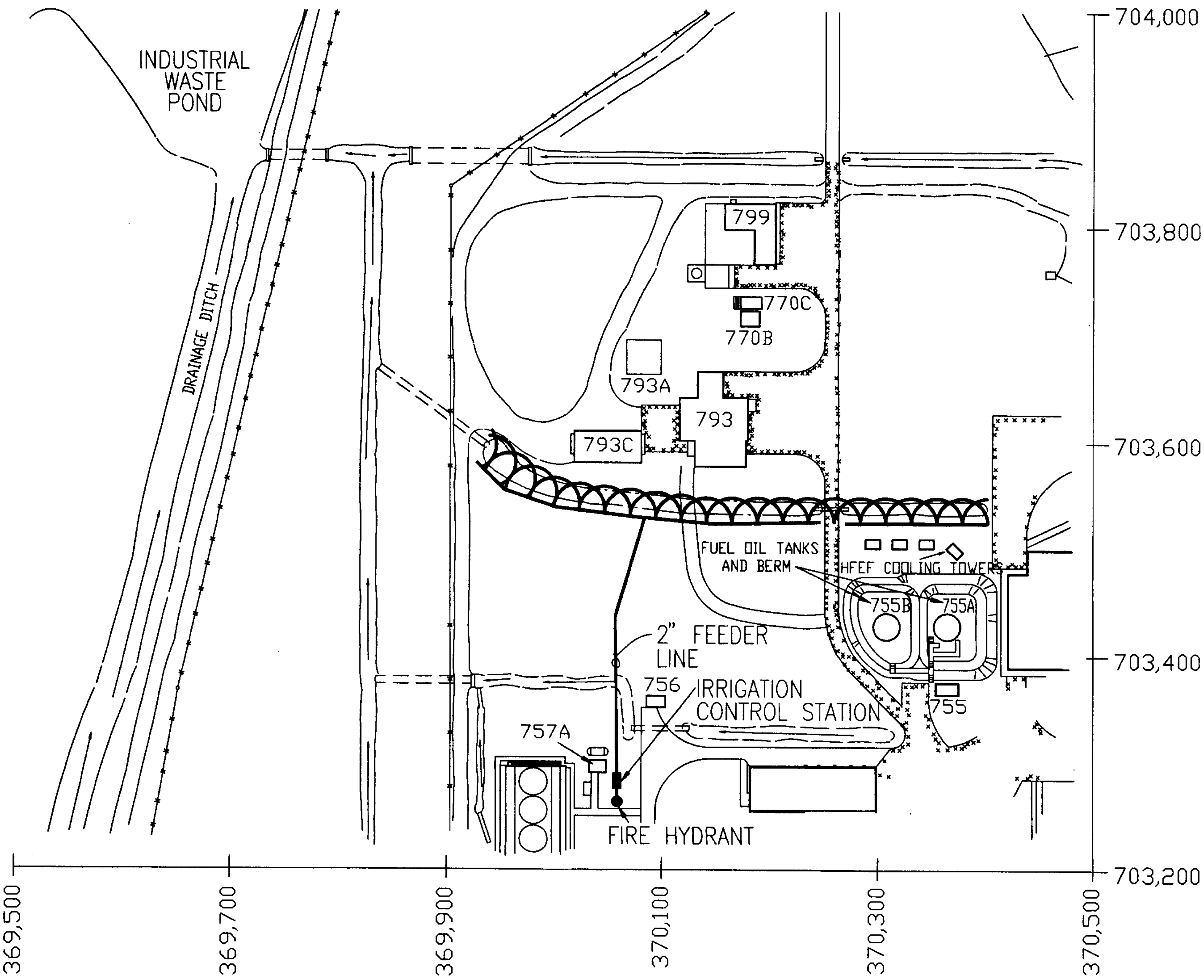
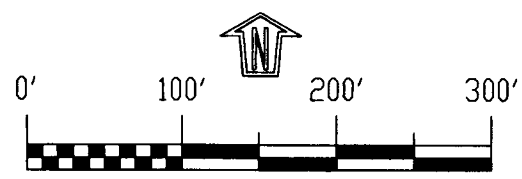
MAIN COOLING TOWER BLOWDOWN DITCH		
DRAWN BY SHERRI L. PALMER	DATE 3-1-99	DWG NO SITE-209.DWG

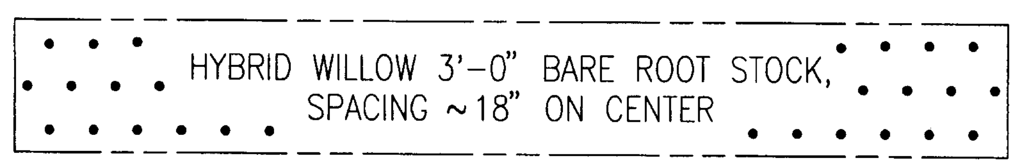


ARGONNE NATIONAL LABORATORY-WEST
ANL-09-MOND
OPERABLE UNIT 9-04 OF WAG-9
INDUSTRIAL WASTE POND
FENCE
704,200
704,000
703,800
703,600
793C
IRRIGATION SPRAY PATTERN
IRRIGATION LINE
703,400
757A
IRRIGATION CONTROL STATION
FIRE HYDRANT
757
703,200
788
703,000
758
702,800
762
702,600
702,400
0' 100' 200' 300'
SCALE IN FEET
369,500
369,700
369,900
370,100
20'-0" CLEAR AREA ON THIS SIDE
60'-0" CLEAR AREA ON THREE SIDES
40'-0"
IRRIGATION LINE FROM WATER SOURCE
APPRO. 500'-0"
KOSHIA SCOPARIA PLANTS SPACING ~ 4" ON CENTER
2% SLOPE
DITCH BARIUM
SCALE: NONE
5'-0"
2'-0"
KOSHIA PLANT
ROOT
16 NELSON R-2000 WINDFIGHTER 360° 1/2" NPT 4.11 GPM EACH 66 GPM TOTAL
48" RISER
NELSON PRESSURE VALVE 30 PSI LOW FLOW RED TOP 3/4" FNPT X 1/2" NPT
30'-0" SECTIONS OF 3" O.D. 3004-H26 RING LOCK
40'-0"
60'-0" CLEAR AREA
20'-0" CLEAR AREA
TYPICAL CROSS SECTION OF MOUND
SCALE: NONE
THIS DRAWING IS THE PROPERTY OF
ARGONNE NATIONAL LABORATORY
INTERCEPTOR CANAL - MOUND
DRAWN BY SHERRI L. PALMER
DATE 2-26-99
DWG NO SITE-207.DWG

ARGONNE NATIONAL LABORATORY-WEST
ANL-35
OPERABLE UNIT 9-04 OF WAG-9







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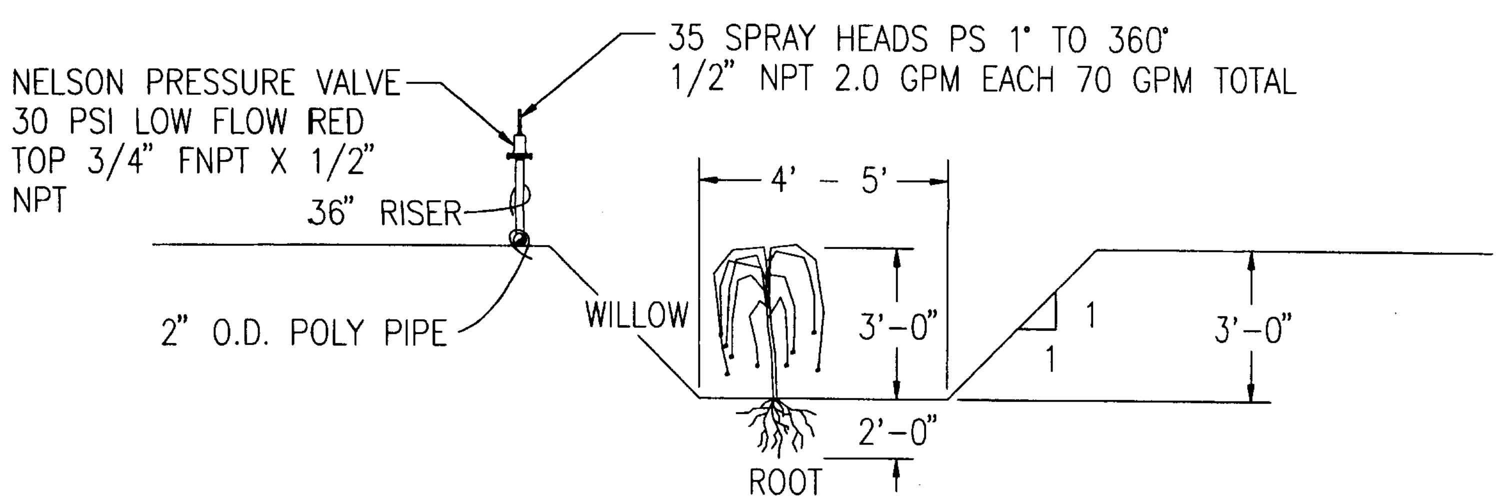
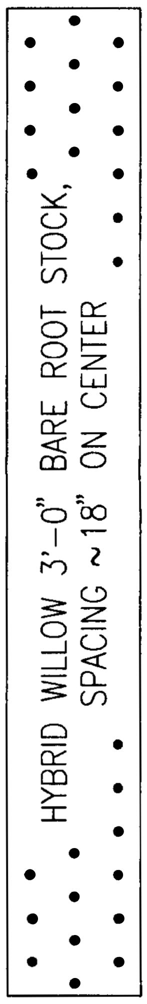


TYPICAL CROSS SECTION OF DITCH

SCALE: NONE

THIS DRAWING IS THE PROPERTY OF ARGONNE NATIONAL LABORATORY		
INDUSTRIAL WASTE LIFT STATION DISCHARGE DITCH		
DRAWN BY: SHERRI L. PALMER	DATE: 3-1-99	DWG NO: SITE-208.DWG

ARGONNE NATIONAL LABORATORY-WEST
SITE PLOT PLAN
OPERABLE UNIT 9-04
OF WAG-9
1994 SAMPLE LOCATIONS



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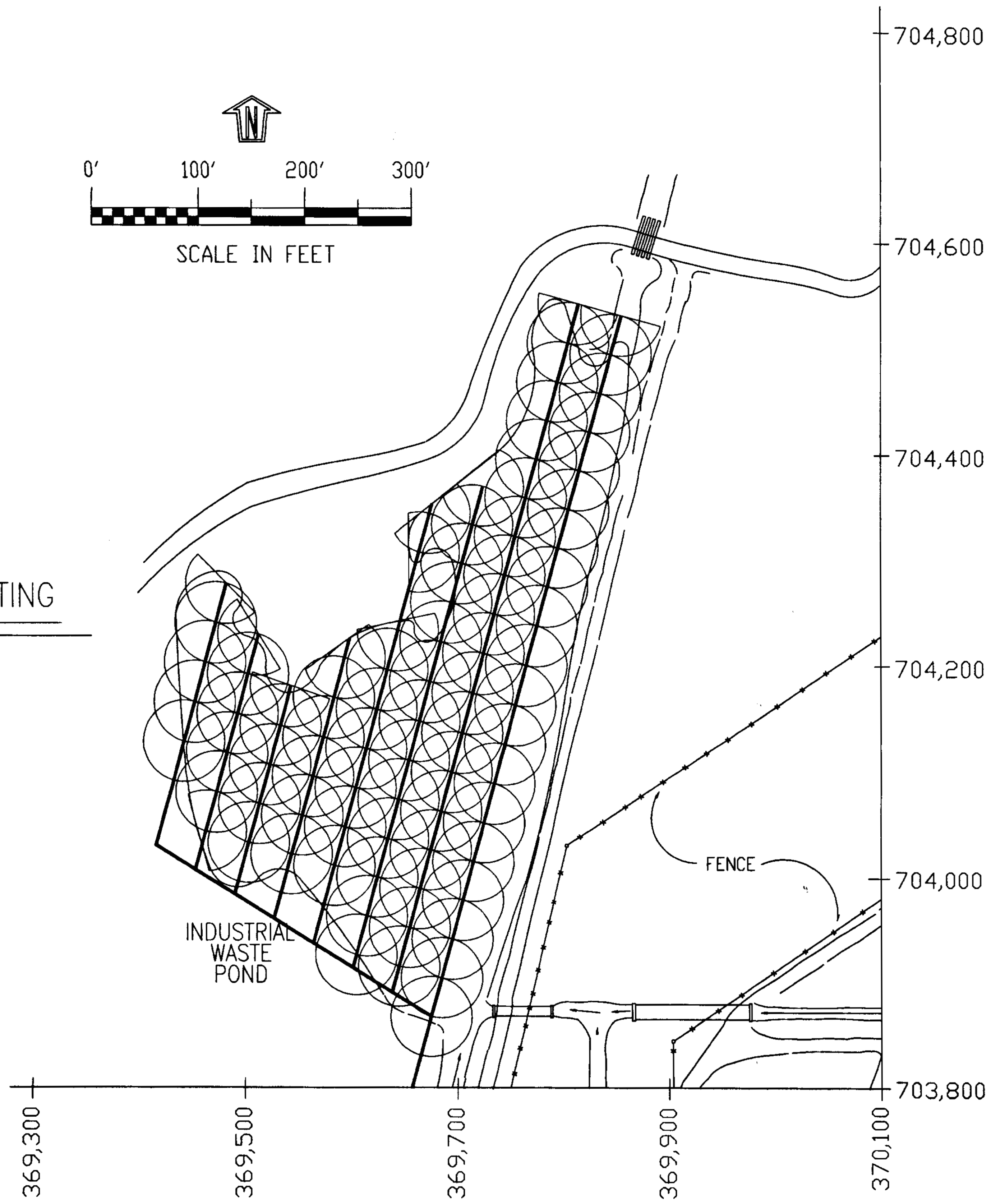
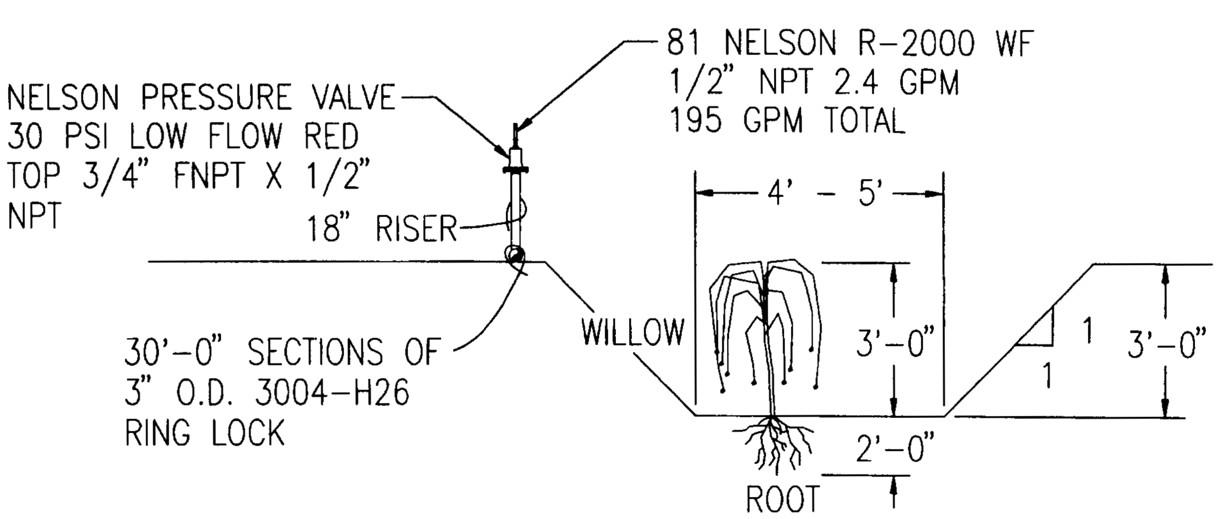
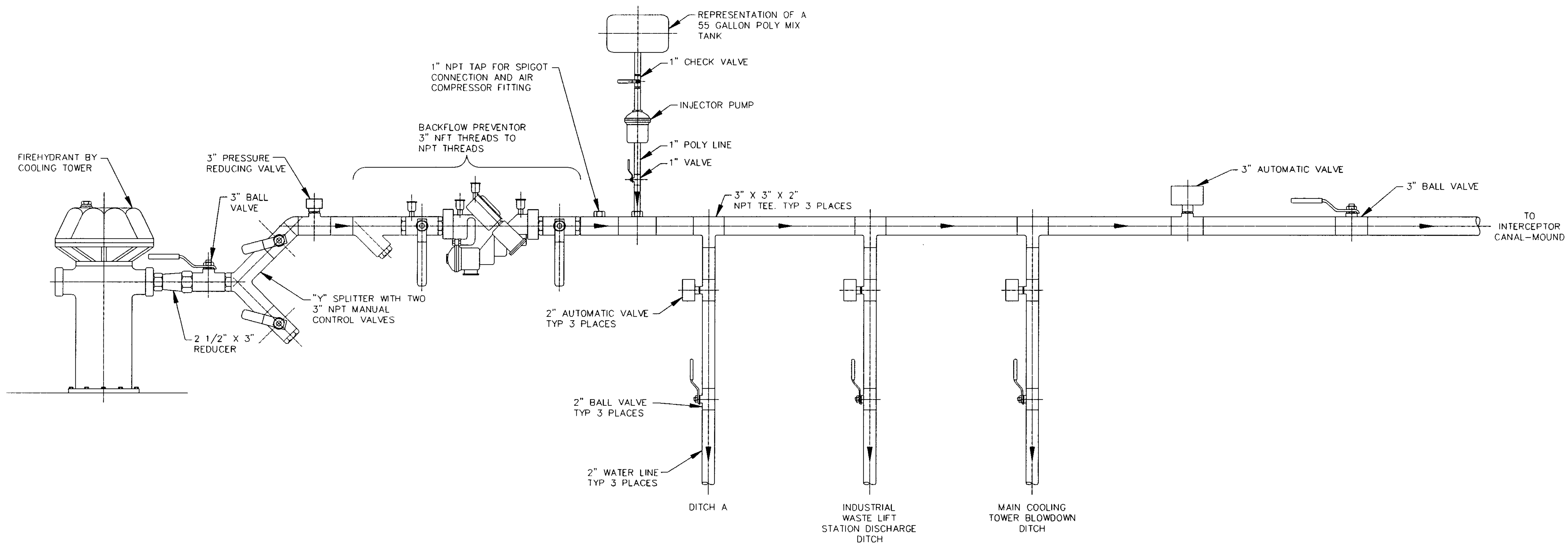




TYPICAL CROSS SECTION OF DITCH

SCALE: NONE

THIS DRAWING IS THE PROPERTY OF ARGONNE NATIONAL LABORATORY		
INDUSTRIAL WASTE POND		
DRAWN BY SHERRI L. PALMER	DATE 3-1-99	DWG NO SITE-211.DWG



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NATIONAL LABORATORY

FIRE HYDRANT MANIFOLD
PIPING SYSTEM

DRAWN BY	DATE	DWG NO
SHERRI L. PALMER	3-1-99	SITE-212.DWG

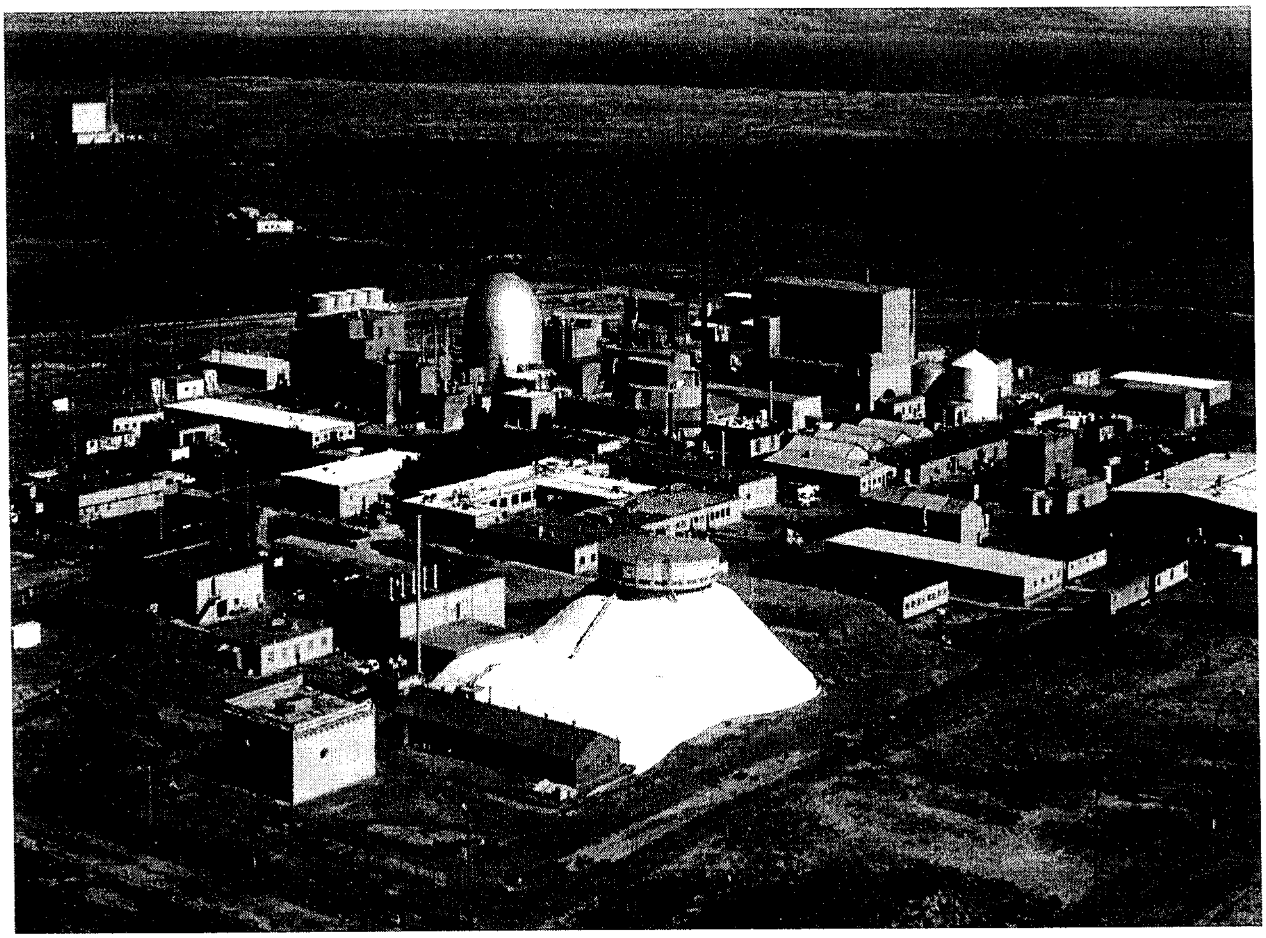
Appendix B

IDAHO NATIONAL ENGINEERING & ENVIRONMENTAL LABORATORY

IDAHO DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENTAL QUALITY

Operations and Maintenance Plan for Argonne National Laboratory - West, Operable 9-04



Operable Unit 9-04
Idaho National Engineering and Environmental Laboratory
Idaho Falls, Idaho

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Operations and Maintenance Plan for Argonne National Laboratory - West, Operable Unit 9-04,

Published October 1999
Document # W0001-1016-ES-00

Prepared by:

The Department of Energy
The Idaho Department of Health and Welfare-Division of Environmental Quality
and
the Environmental Protection Agency-Region 10

Operable Unit 9-04
Idaho National Engineering and Environmental Laboratory
Idaho Falls, Idaho

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Abstract

The final Record of Decision (ROD) for Waste Area Group 9, Operable Unit (OU) 9-04, was signed in September 1998. This Record of Decision provides for long-term (100 years) operations and maintenance for three sites at Argonne National Laboratory-West (ANL-W). These three sites have remediation-goal cleanup levels established for current radionuclide activity levels that will decay to acceptable levels in 100 years. The three sites at ANL-W that require operations and maintenance are the Industrial Waste Pond, Interceptor Canal-Canal, and Interceptor Canal-Mound. All three sites have cesium-137 as the radionuclide that poses an unacceptable risk under the current and future resident scenarios. When these three sites are remediated, the remaining cesium-137 activity is equal to or less than the established remediation goal, and natural decay of the cesium-137 has occurred for the next 100 years, the three sites would no longer require the institutional controls and continuation of this operations and maintenance plan.

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Tables

ACRONYMS

ANL-W	Argonne National Laboratory - West
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQ	Division of Environmental Quality
DOE-CH	Department of Energy-Chicago Operations Office
EPA	Environmental Protection Agency - Region 10
GPRS	global-positioning radiometric scanner
IDHW	Idaho Department of Health and Welfare
INEEL	Idaho National Engineering and Environmental Laboratory
O&M	Operations and Maintenance
OU	Operable Unit
ROD	Record of Decision
RGs	remediation goals
WAG 9	Waste Area Group 9

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Waste Area Group 9
Operations and Maintenance Plan

1 GENERAL

This site-specific operation and maintenance (O&M) plan describes the activities and procedures required for institutional controls at the Industrial Waste Pond, Interceptor Canal-Canal, and Interceptor Canal-Mound sites at ANL-W. The location of each site with respect to ANL-W is shown in Figure 1-1. In addition, five areas at ANL-W that pose unacceptable ecological risks will undergo remedial action and be remediated to concentrations that will be protective of human health and the environment. The remaining 33 sites at ANL-W do not pose unacceptable risks to human health and the environment and do not require any remedial action or any ongoing operations and maintenance procedures.

After remediation activities have been completed and the remediation goals met, ongoing operation and maintenance comprise the scope of anticipated activities. Basic elements of this O&M plan include (refer to Table 1-1):

- Description of inspection procedures.
- Procedures for repair and maintenance of signs and barriers (as part of the institutional controls).
- Reporting policies and practices.

Photographs will be used to enhance the informative quality of documentation whenever possible, particularly when scheduled maintenance activities result in comments by the inspector. A record of these photographs, preserved in a site inspection photo log, will be maintained by the Waste Area Group (WAG) 9 remediation project manager and made available for review by the U.S. Department of Energy Chicago Operations Office (DOE-CH), U.S. Environmental Protection Agency (EPA) Region 10, and the Idaho Department of Health and Welfare (IDHW) Division of Environmental Quality (DEQ).

This O&M plan is intended only to serve as a procedure for monitoring ongoing operations at the site and to identify maintenance activities that will be conducted. It is not intended to serve as an Institutional Control Plan or as a five-year review document. However, these documents do have similarities and aspects of tasks performed as part of this O&M Plan may be utilized in the other documents.

Table 1-1. Long-Term Monitoring Requirements for OU 9-04.

Site	Requirement	Action
Industrial Waste Pond	Groundwater monitoring must continue for the next 20 years to ensure that concentrations do not increase and that modeling predictions remain valid.	Semi-annual groundwater samples will be collected for the next 20 years in accordance with the WAG 9 Groundwater Monitoring Plan.
	Radiological surveys must be performed every 5 years to ensure that radionuclide concentrations are not increasing.	Surveys will be conducted by a Health Physics Technician in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan every 5 years.
	The area must be posed with institutional controls (signs, markers, and land-use restrictions) for the next 100 years.	Inspections will be conducted by an environmental engineer in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan.
Interceptor Canal-Canal	Groundwater monitoring must continue for the next 20 years to ensure that concentrations do not increase and that modeling predictions remain valid.	Semi-annual groundwater samples will be collected for the next 20 years in accordance with the ANL-W Groundwater Monitoring Plan.
	Radiological surveys must be performed every 5 years to ensure that radionuclide concentrations are not increasing.	Surveys will be conducted by a Health Physics Technician in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan every 5 years.
	The area must be posed with institutional controls (signs, markers, and land-use restrictions) for the next 100 years.	Inspections will be conducted by an environmental engineer in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan.
Interceptor Canal-Mound	Groundwater monitoring will continue for the next 20 years to ensure that concentrations do not increase and that the modeling predictions remain valid.	Semi-annual groundwater samples will be collected for the next 20 years in accordance with the WAG 9 Groundwater Monitoring Plan.
	Groundwater monitoring must continue for the next 20 years to ensure that concentrations do not increase and that modeling predictions remain valid.	Inspections will be conducted by an environmental engineer in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan.
	Radiological surveys must be performed every 5 years to ensure that radionuclide concentrations are not increasing.	Revegetation and erosion surveys will be conducted in accordance with Table 5-1 of this O&M Plan
	The area must be posed with institutional controls (signs, markers, and land-use restrictions) for the next 100 years.	Surveys will be conducted by a health physics technician in accordance with Table 5-1 of this O&M Plan and with Table 10-1 of the OU 9-04 Remedial Action Work Plan every 5 years.

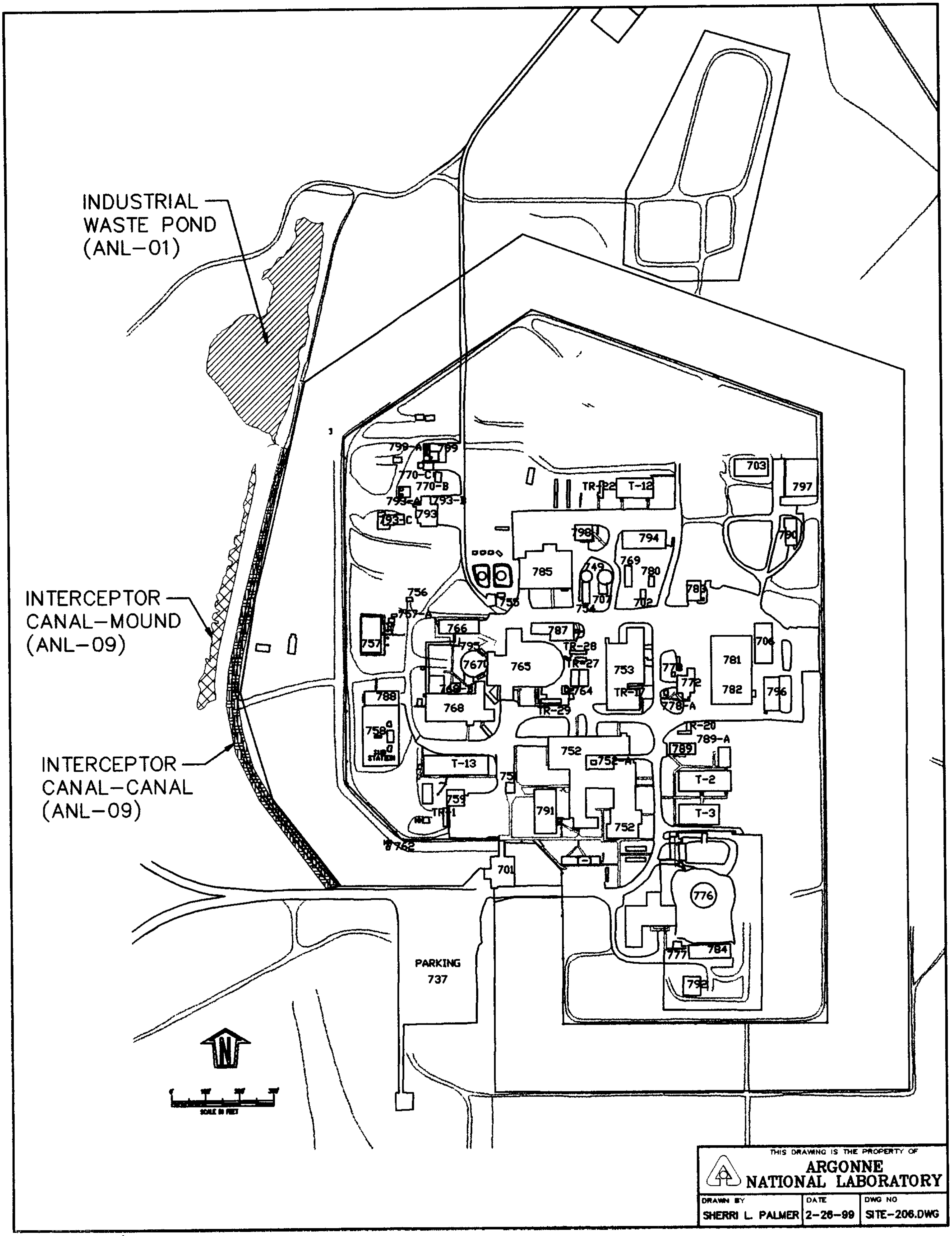

Figure 1-1. Location of the three WAG 9 OU 9-04 sites covered by this O& M plan.

2 REVEGETATED AREAS AND EROSION CONTROL

Reseeding will be performed only at the ANL-W Interceptor Canal-Mound site. This site is located west of ANL-W outside the security fences. The irrigation system at the Interceptor Canal-Mound will remain inplace and active while the revegetation activities are being completed. DOE anticipates that it would only take one to two years of supplemental watering to establish a successful revegetation of the Interceptor Canal-Mound. The other WAG 9 sites being remediated are active drainage ditches or surface water infiltration/evaporation ponds and will not be revegetated. The drainage ditches will continue to drain surface water runoff from rainfall or rapid melting of snow. All of the surface water runoff at ANL-W flows to the west and then is routed to the north to the Industrial Waste Pond. The Industrial Waste Pond will remain in service as a water infiltration and evaporation pond.

The Interceptor Canal-Mound reseeded area will be monitored qualitatively during annual inspections, in late summer for 3 years following reseeding to ensure proper growth. Qualitative determinations of nongrowth or sparse growth areas will be made through comparative growth evaluations in undisturbed areas near the disturbed areas with consideration of the length of time since planting. Information will be recorded on the inspection reporting forms shown in Appendix A of this document. If seeding failure is experienced, as evidenced by lack of perennial grass establishment, and invasion by weeds (primarily Russian thistle, cheatgrass, and tumble mustard) will be documented and photographed. Reseeding and fertilization procedures will be evaluated to determine what went wrong with the original seeding and updated as necessary. Reseeded areas will require follow-up inspections in late summer for 3 years to verify successful reseeding.

Surface erosion is not anticipated to be a problem at the Interceptor Canal-Mound site since it will have been leveled to grade with an approximately 2% slope toward the west. Observations of soil movement, as evidenced by the accumulation of soil on the up-slope side of plants, pedestaling of plants or rocks, or formation of rills or gullies, will be recorded (on the inspection reporting forms in Appendix A) with the extent of erosion noted. If rills and gullies are detected, appropriate soil will be added and compacted to bring the affected area up to the surrounding grade, as determined by visual approximation, and then reseeded. Photographs will be taken as needed.

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3 MONITORING

Surface radiological monitoring will be performed every five years to identify potential migration from the Industrial Waste Pond, Interceptor Canal-Canal, and the Interceptor Canal-Mound to ensure that existing institutional controls are protective of residential exposure for ANL-W. Radiological-surface surveys will be performed using a global-positioning radiometric scanner (GPRS) mounted on the front of a four-wheel drive vehicle. The GPRS system will be used to locate and document areas of high gamma activity. For areas identified by the GPRS that are above previous surveys, a portable high-purity germanium gamma spectroscopy detector will be used to determine if the radiological contamination is above the remediation goals (RGs), as identified in OU 9-04 ROD. If radionuclide contamination is above the RGs, DOE-CH, U.S. Environmental Protection Agency Region 10, and Idaho Department of Health and Welfare Division of Environmental Quality will be notified and corrective actions will be determined by these agencies.

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4 INSTITUTIONAL CONTROLS

The purpose of institutional controls is to restrict human access to the Industrial Waste Pond, Interceptor Canal-Canal, and Interceptor Canal-Mound. By restricting access to these sites the exposure pathway for cesium-137 to human residents in aresidential-exposure scenario can be controlled. Thus, by preventing exposure, risks are acceptable. Institutional controls will be evaluated and inspected during the 5-year reviews. Institutional controls include:

- Site signs
- Permanent markers
- Postings
- Land use restrictions.

The controls will be inspected and their status registered on the inspection reporting form (shown in Appendix A). Institutional controls found to be damaged or missing will be repaired or replaced.

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5 ORGANIZATION AND RESPONSIBILITIES

This section outlines the organizational practices that will drive O&M activities and specifies individuals responsible for inspections, repairs, and reporting required by WAG 9, OU 9-04.

5.1 Organization

5.1.1 DOE Project Manager

The DOE-CH WAG 9 Remediation Project manager is responsible for the following:

- Ensuring the O&M activities are performed in accordance with the approved plan
- Coordinating activities of the INEEL operating contractor at WAG 9, OU 9-04.

5.1.2 ANL-W WAG 9, OU 9-04 Remediation Project Manager

As the point of contact for O&M activities, the ANL-W WAG 9 Remediation Project Manager is responsible for the following:

- Ensuring copies of inspection reports, are placed in the project records file
- Administrating subcontracts for performing required repairs
- Reporting activities to DOE-ID.

5.2 Conducting Inspections and Repairs

5.2.1 Inspections

The WAG 9 ANL-W Remediation Project Manager will provide qualified personnel to inspect signs, permanent markers, postings, and land use restrictions per institutional controls for the Industrial Waste Pond, Interceptor Canal-Canal, and Interceptor Canal-Mound in accordance with the approved O&M plan. These inspections will be documented in accordance with Section 6 of this document. Table 5-1 summarizes the inspection schedules for the Industrial Waste Pond, Interceptor Canal-Canal, and the Interceptor Canal-Mound sites. Personnel will be trained on requirements of the approved plan prior to performing these inspections. The ANL-W WAG 9 Remediation Project Manager is responsible for implementation and reporting of inspections.

After 5 years, the frequency of inspection and reporting will be reevaluated by WAG 9 DOE-CH, U.S. Environmental Protection Agency Region 10, and Idaho Department of Health and Welfare Division of Environmental Quality Remediation Project Managers.

Table 5-1. Summary of the OU 9-04 Inspection Schedules.

Inspections	Frequency
Revegetation with native plants[a]	In late summer for 3 years following seeding
Erosion survey	Every 5 years
Radiological surveys	Every 5 years
Signs and postings	Every 5 years
Permanent markers	Every 5 years
Land use restrictions	Every 5 years

a. Interceptor Canal-Mound only.

5.2.2 Repair/Replacement of Material

The ANL-W WAG 9 Remediation Project Manager will obtain the services of qualified personnel, as necessary, to repair or replace any warning signs and postings around the WAG 9, OU-9-04 sites (identified by inspections) that require corrective action in accordance with the approved O&M plan. The Remediation Project Manager will provide construction management support for maintenance activities and document all repairs or replacements in accordance with current procedures.

6 REPORTING REQUIREMENTS

6.1 Inspection

Inspections of the WAG 9, OU 9-04 sites will fall into three types:

- Scheduled inspections
- Follow-up inspections for reseeding
- Contingency Inspections.

Scheduled inspections are summarized in Table 5-1. Follow-up inspections for repair/replacement activities will occur as determined by the ANL-W Remediation Project Manager. Contingency inspections are unscheduled inspections ordered by DOE-CH; trigger events for these inspections may include severe rainstorms, floods, or highly unusual events such as tornadoes or earthquakes.

The ANL-W WAG 9 Remediation Project Manager will record inspection results on the attached inspection reporting forms (Appendix A). The forms will be completed, signed, dated, and submitted to DOE-CH annually, or as needed in the case of contingency inspections.

6.2 Maintenance

No routine maintenance is planned for the sites. Unscheduled custodial maintenance activities will be determined during inspections. The ANL-W WAG 9 Remediation Project Manager will develop the work plan citing required maintenance activities as identified by inspection reports to be submitted to the DOC-CH for required maintenance activities. The work plan will include a technical work scope, cost estimate, schedule, a reference list of existing applicable technical specifications and drawings, and health and safety requirements.

6.3 Reporting

The five year O&M report will include documentation of scheduled inspections, follow-up and contingency inspections, and maintenance activities. This O&M report will attached to the CERCLA 5 year review checklist and include:

- A summary of the inspection
- A summary of maintenance activities to date
- An estimate of maintenance activities required in the upcoming years
- An assessment of inspection data, and applicable photos
- A list of field inspector names and qualifications
- A copy of the appropriate inspection report forms.

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Appendix A

Inspection Report Forms for ANL-W OU 9-04 Operations and Maintenance Plan

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5 Year Inspection Form

for the ANL-W Industrial Waste Pond
as Required by the

OU 9-04 Operations and Maintenance Plan

Task	Yes	No
Has an on site inspection been completed?		
Are human residents living within 50 meters of the Industrial Waste Pond site?		
Are the warning signs in place and still readable at the Industrial Waste Pond site?		
Are the land use restrictions for the Industrial Waste Pond recorded and available for inspection at the Bingham county courthouse?		
Are radiological survey results increasing?		
Were any air, soil, or groundwater samples collected? If yes attach summary of results.		
Are there any construction or mining activities that threaten to encroach on or undermine this site?		
Are the Institutional Controls (warning signs and land use restrictions) at the Industrial Waste Pond site still protective?		
Are current photos of this site attached to this checklist?		
Is the current responsible federal agency contact person and address identified and attached to this check list?		
Is a review needed prior to the next five year review?		
Scheduled date for submittal of next five-year review		

Signature of Engineer Responsible for completing this review Date

_______________________________________ __________

5 Year Inspection Form

for the ANL-W Interceptor Canal-Mound as Required by the

OU 9-04 Operations and Maintenance Plan

Task	Yes	No
Has an on site inspection been completed?		
Are the revegetation growing and adequately covering the area?		
Does the area show signs of erosion and runoff that need to be repaired?		
Has the area subsided causing ponding of surface water ?		
Are human residents living within 50 meters of the Interceptor Canal-Mound site?		
Are the warning signs in place and still readable at the Interceptor Canal-Mound site?		
Are the land use restrictions for the Interceptor Canal-Mound recorded and available for inspection at the Bingham county courthouse?		
Are the radiological survey results increasing?		
Were any air, soil, or groundwater samples collected? If yes attach summary of results.		
Are there any construction or mining activities that threaten to encroach on or undermine this site?		
Are the Institutional Controls (warning signs and land use restrictions) at the Interceptor Canal-Mound site still protective?		
Are current photos of this site attached to this checklist?		
Is the current responsible federal agency contact person and address identified and attached to this check list?		
Is a review needed prior to the next five year review?		
Scheduled date for submittal of next five-year review		

Signature of Engineer Responsible for completing this review ______________________ Date __________

5 Year Inspection Form

for the ANL-W Interceptor Canal-Canal as Required by the

OU 9-04 Operations and Maintenance Plan

Task	Yes	No
Has an on site inspection been completed?		
Are human residents living within 50 meters of the Interceptor Canal-Canal site?		
Are the warning signs in place and still readable at the Interceptor Canal-Canal site?		
Are the land use restrictions for the Interceptor Canal-Canal recorded and available for inspection at the Bingham county courthouse?		
Are the radiological survey results increasing?		
Were any air, soil, or groundwater samples collected? If yes attach summary of results.		
Are there any construction or mining activities that threaten to encroach on or undermine this site?		
Are the Institutional Controls (warning signs and land use restrictions) at the Interceptor Canal-Canal site still protective?		
Are current photos of this site attached to this checklist?		
Is the current responsible federal agency contact person and address identified and attached to this check list?		
Is a review needed prior to the next five year review?		
Scheduled date for submittal of next five-year review		

Signature of Engineer Responsible for completing this review	Date
______________________________	__________

Appendix C

Appendix C

WAG 9
Quality Assurance Project Plan
For Argonne National Laboratory-West
for Remedial Action in OU 9-04
at the Idaho National Engineering and Environmental Laboratory

Prepared By
Argonne National Laboratory-West

WAG 9
Quality Assurance Project Plan
For Argonne National Laboratory-West
Remedial Action in OU 9-04
at the Idaho National Engineering and Environmental Laboratory

Published March 1999

Revision 0
W0001-1015-ES-00

Prepared By: 2-26-99

S. D. Lee, Environmental Engineer | Date

Approved By:

Environmental and Waste Management Projects, Manager | Date

NTD Quality Assurance, Representativer | Date

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the U.S. Department of Energy
and University of Chicago for Management and Operations of
Argonne National Laboratory
Under DOE Chicago Operations Office
Contract W-31-109-ENG-38 Mod # 239

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WAG 9
Quality Assurance Project Plan
For Argonne National Laboratory-West
Remedial Action in OU 9-04
at the Idaho National Engineering Laboratory

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ACRONYMS

ANL-W	Argonne National Laboratory - West
ANSI	American National Standards Institute
ASTM	American Standard Testing Methods
CLP	Contract Laboratory Program
COC	Chain of Custody
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
DOE	Department of Energy
DOE-CH	Department of Energy, Chicago Operations Office
DOE-ID	Department of Energy, Idaho Operations Office
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ER	Environmental Restoration
ESWM	Environment, Safety and Waste Management
FSP	Field Sampling Plan
INEEL	Idaho National Engineering and Environmental Laboratory
IDHW	Idaho Department of Health and Welfare
MDL	Method Detection Limit
MS	Matrix Spike
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PQL	Practical Quantitation Limits
QA/QC	Quality Assurance/Quality Control
QAPjP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RQL	Required Quantitation Limit
RRDL	Required Radiological Detection Limit
RSD	Relative Standard Deviation
RWP	Radiation Work Permit
SOP	Standard Operation Procedures
SOW	Statement of Work
SRPA	Snake River Plain Aquifer
SWP	Safe Work Permit
TCLP	Toxicity Characteristic Leaching Procedure
WAG	Waste Area Group

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1. PURPOSE

This Quality Assurance Project Plan (QAPjP) is created for the Environmental and Waste Management Projects (EWMP) section of the Nuclear Technology Division (NTD) of Argonne National Laboratory-West (ANL-W) located on the Idaho National Engineering and Environmental Laboratory (INEEL). This document presents the functional activities, organization, and quality assurance/quality control (QA/QC) protocols required to achieve the Data Quality Objectives (DQOs) dictated by the end use of the data.[1,2] This plan will be used for collection of all environmental and radiological verification samples, testing, measurement, and data review activities for Waste Area Group (WAG) 9. This QAPjP will be used in conjunction with a site specific Remedial Action Workplan. The ANL-W Quality Assurance (QA) Program, based upon 10 CFR 830.120, and DOE Order 5700.6C is the overall ANL-W QA Program, along with Nuclear Technology Divisions' management plan, which contains additional QA requirements for EWMP.

2. PROJECT DESCRIPTION

ANL-W is part of the INEEL, a federally owned reservation that is dedicated mainly to energy development and research. The INEEL was established in 1949 on the Snake River plain of southeast Idaho. It covers an area of 893 square miles (2313 km^2). The area now administered by ANL-W is slightly over one square mile (2.6 km^2). The ANL-W site is located approximately 30 miles west of the city of Idaho Falls, just north of U.S. Highway 20. Figure 1 shows the location of the ANL-W site with respect to the state of Idaho.

The INEEL has been divided into ten WAGs to facilitate the remediation process as defined by the Federal Facility Agreement and Consent Order (FFA/CO)[3]. Each WAG is further divided into Operable Units (OUs) which focus on specific areas of interest. ANL-W is WAG 9, which has been divided into four OUs and consists of 37 identified sites. These OUs are: 9-01 Track 1 sites, 9-02 Track 2 site with low level radioactivity, 9-03 Track 2 low level radioactive and nonradioactive sites, and 9-04 Remedial Investigation and Feasibility Study (RI/FS) sites. The Environmental Protection Agency (EPA) has been identified as the lead agency and the State of Idaho Department of Health and Welfare (IDHW) as the support agency for WAG 9 OUs.[3]

3. PROJECT ORGANIZATION AND RESPONSIBILITIES

The overall project organizational structure for ANL-W personnel, subcontractor personnel, and Department of Energy (DOE) personnel is shown in Figure 2. Key organizational responsibilities are described as follows:

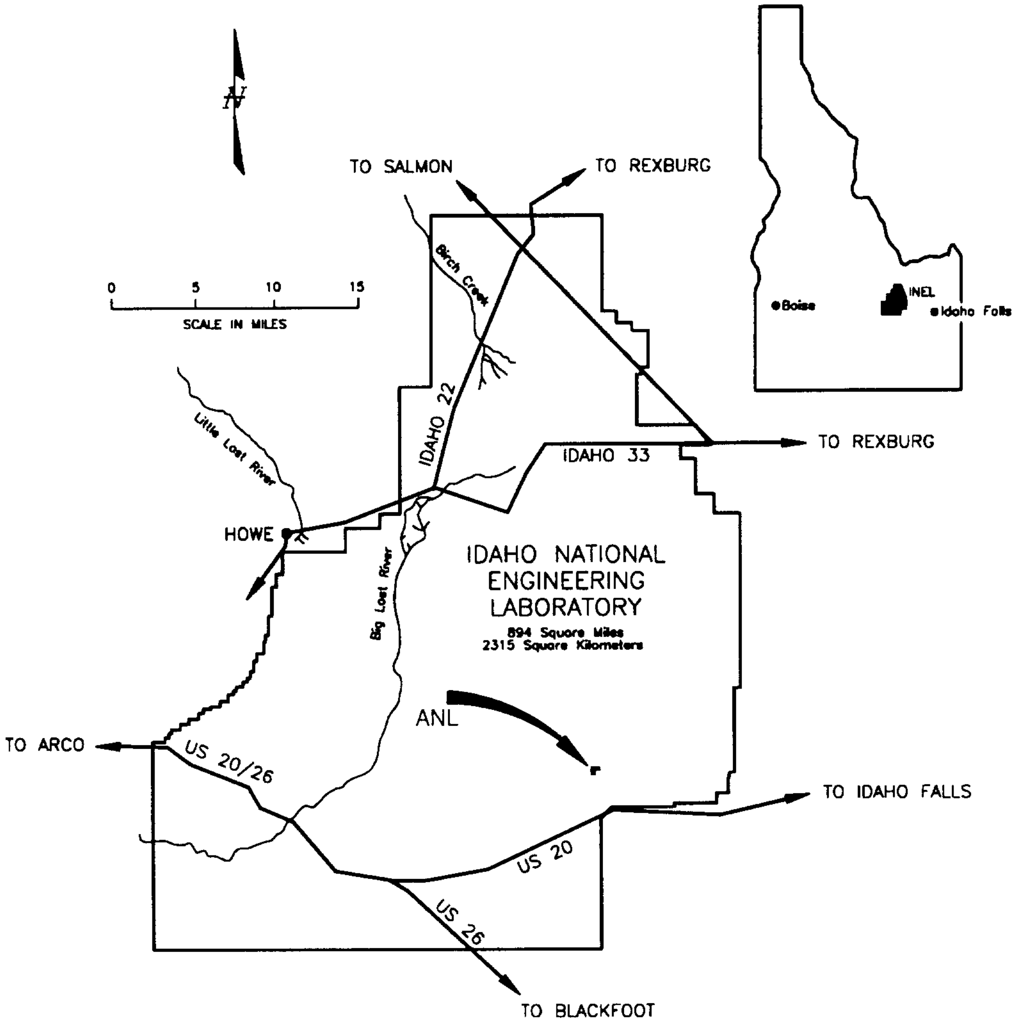

Figure 1. Location of ANL-W with Respect to the INEEL and the State of Idaho

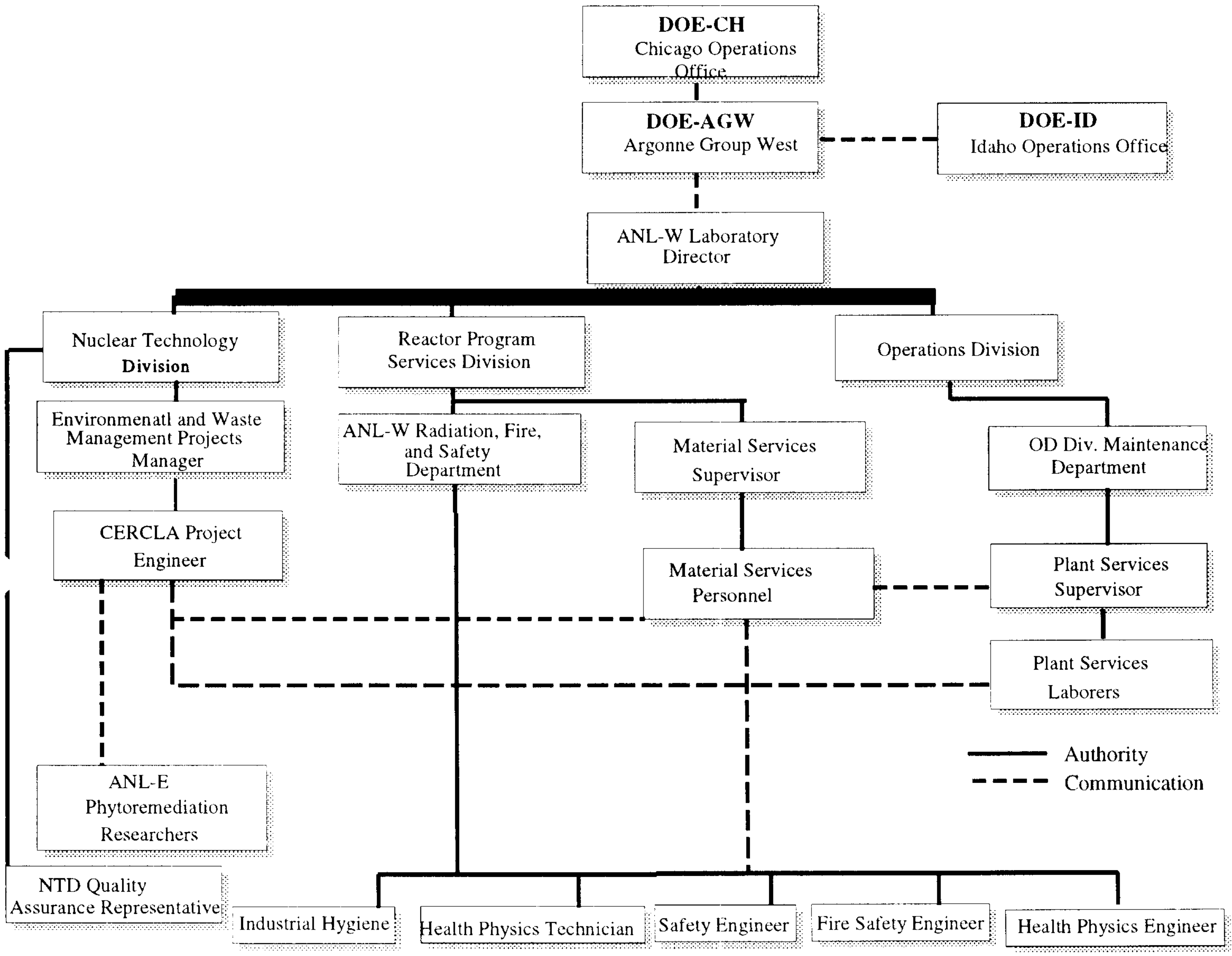

Figure 2. Project Organizational Structure for Remediation Activities at ANL-W

- ANL-W CERCLA Project Engineer: The CERCLA Project Engineer is responsible for overall technical direction of the remedial action, providing direction to field team members, provision or coordination of all required personnel and subcontractor training, and for ensuring that ANL-W and subcontractor personnel and equipment resources are made available to support the needs of all field and laboratory operations conducted pursuant to the requirements of the Remedial Action Work Plan.

- NTD Quality Assurance Representative: The NTD Quality Assurance Representative assigned to the investigation shall be responsible for monitoring and verifying technical performance in compliance with the requirements of the Remedial Action Work Plan and its implementing procedures. The Quality Assurance Representative is responsible for coordinating any required external program assessment support services and is also responsible for initiating and/or coordinating corrective action as necessary to ensure that the technical and quality goals of the investigation are achieved. The systems and program assessment methods are described in Section 10 of this QAPjP.

- ANL-W Site Safety Engineer: The ANL-W Site Safety Engineer is responsible for conducting safety briefings at the start of each shift, and for initiating any required measures necessary to protect the health and safety of the site personnel.

4. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENTS

The overall project objective of a field investigation is to produce data of known type and quality that can be used to show that the remediation goals are met. Typically precision, accuracy, detection limit, completeness, comparability, representativeness, and analytical levels are used to determine the quality of the data.

The QA objectives are divided into those objectives which are quantitative and qualitative. The governing QA document for ANL-W is W0001-0929-QM. The quantitative QA objectives are those for which calculations of the numeric output can be used to determine if QA requirements are met. The qualitative QA objectives are those which do not require calculations of actual analytical data. QA objectives are needed for all critical measurements and for each type of sample matrix.[5] A discussion of whether the DQOs of the project have been met, and the impacts on the decision process will be included in the data validation report.

4.1 Quantitative Quality Assurance Objectives

The quantitative QA parameters are precision, accuracy, detection limit, and completeness. The accuracy, precision, and method detection limit goals are contained in Tables 1 through 11 located in Attachment A.

4.1.1 Precision

Precision is a measure of the reproducibility of a measurement under a given set of conditions.[6] Precision is stated in terms of relative percent difference (RPD) for two measurements (or observations) or the relative standard deviation (RSD) for three or more measurements (or observations). The formulas for calculating RPD and RSD are contained in Section 11.1 of this QAPjP.

4.1.1.1 Field Precision

Field precision is a measure of the variability of the sampling matrix, which is not due to the laboratory or analytical methods. Field precision will be evaluated and compared to EPA minimum acceptable levels. ANL-W will use a confidence level of 80 percent precision for duplicate and/or split samples.[9,10,&11] Table 12 contains the guidelines that will be used by ANL-W for duplicate and spli. samples.

4.1.1.2 Laboratory Precision

Laboratory precision will be calculated as defined in Section 8.1 of this QAPjP. Precision goals for inorganic, organic, and radiological analysis have been established by the EPA [7, 8] and ANL-W Standard Operating Procedures (SOP) are included in the ANL-W Environmental Procedures Manual.[12,13,14,15,&16]

4.1.2 Accuracy

Accuracy measures the bias in a measurement. Accuracy is a function of the sampling technique in the field and the analytical methods of the laboratory.

4.1.2.1 Field Accuracy

Field accuracy errors are caused by inadequate sample preservation, poor handling, field contamination, and the sample matrix itself. Poor sampling technique and preservation or field contamination of the samples would yield inaccurate results. Sampling accuracy may be assessed by evaluating the results of field and trip blanks as described in Section 11.2.

4.1.2.2 Laboratory Accuracy

Sources of laboratory error include: improper handling, matrix interference, dissimilar sample matrix, wrong sample preparations, and poor analytical technique. Analytical accuracy may be assessed through use of percent recovery information on known and/or blind QC samples and matrix spikes (MS).[25]

Tables 1 through 3 reflect the MS percent recovery control limits for organic analysis, as defined by the EPA Contractor Laboratory Program (CLP) Statement of Work (SOW). The organic analysis is not specified at this time but, is included in case organic analysis is added at a later date. The MS recovery , i.e., laboratory accuracy for organic analyses, must be within these control limits or flagged during the data validation process. If volatile organic compounds samples are collected, the trip and field blanks will also be used to assess the laboratory accuracy.

Accuracy for inorganic analysis shall be assessed through the use of laboratory control samples and/or single blind control samples and the MS. The established control limits are as follows: spike recovery within 25 percent and laboratory control sample within 20 percent of the known value.

Accuracy levels for radiological analysis shall be assessed through the use of percent recovered data from spiked blanks and the uncertainty limits established on a per sample basis.

4.1.3 Detection Limit

Detection limits for the various analyses must meet or exceed the risk-based concentrations for the contaminants of concern. Detection limits used at ANL-W will be either: Contract Required Quantitation Limits (CRQL) for CLP organics or Contract Required Detection Limits (CRDLs) for CLP inorganics;[26] Practical Quantitation Limits (PQLs) for Toxicity Characteristic Leaching Procedure (TCLP) volatile or semivolatile organics, or Required Quantitation Limits (RQLs) for TCLP metals, or Method Detection Limits (MDLs) for pesticides, herbicides, and miscellaneous analytes; or Required Radiological Detection Limits (RRDLs). When groundwater samples will be used to calculate the ingestion pathway in a risk assessment, EPA method 524.2 will be used for organics.[27]

4.1.4 Completeness

The completeness of the data is a comparison of the percentage of samples for which acceptable data are generated out of the total number of samples planned in the FSP. The completeness goal for ANL-W will be 90 percent. Factors affecting completeness include: instrument malfunctions, insufficient sample recovery, expired holding times, samples damaged during shipping, handling, storage, or data that cannot be validated.

4.2 Qualitative QA Objectives

The qualitative QA parameters are comparability analytical levels and representativeness.

4.2.1 Comparability

Comparability is the confidence level obtained when one data set is compared to another. Data comparability will be achieved using standard field and analytical methods to compare samples, similar detection limits, similar collection, and preparation procedures.

4.2.2 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, the parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that addresses the proper design of the sampling program. The representativeness criterion is best satisfied by confirming that sampling locations and methods are selected and documented properly and that a sufficient number of samples are collected.

4.2.3 Analytical Levels

EPA has established five analytical levels (I, II, III, IV, and V) which correspond to data uses.[28] ANL-W will specify which level of data is required for a specific site in the FSP. Typically ANL-W will only use Levels II, III, and IV. A brief description of each of the analytical levels is shown below:

I — Typically field screening or analysis using portable instruments. Results are often not compound specific nor quantitative, but the results are available in real time. It is the least costly of the analytical options.

II — Field analysis using more sophisticated portable analytical instruments in some cases the instruments may be set up in a trailer at the site being investigated. There is a wide range in the quality of data that can be generated depending on the use of suitable calibration standards, reference materials, sample preparation equipment, and operator training. Results are available in real time or in several hours.

III — Analysis performed in a laboratory following well documented and standardized procedures. Procedures may be approved by the EPA or the American Society for Testing and Materials (ASTM), but other well-documented procedures with controlled analytical methods such as those used by the U.S. Geological Survey or the INEEL Radiation Measurements Laboratory are acceptable. Analytical precision and accuracy must be either documented in procedures or determined from standards, duplicates, and blanks. The extensive documentation procedures required by the CLP Level IV analysis are not utilized.

IV — Analysis performed at a laboratory following EPA approved procedures including but not limited to the EPA CLP Routine Analytical Services (RAS) protocols and SW-846. Any analytical data must be accompanied by a complete CLP type data package containing all raw laboratory data. The quality control requirements of the methods and the documentation of quality control results must be as thorough as those used in the CLP protocols.

V — Laboratory analysis following non-CLP procedures, modified EPA procedures, with delivery of a data package containing all raw laboratory data and quality control results (CLP type data package).

5. SAMPLING

The objective of the sampling locations and sampling procedures is to obtain a sample that represents the environment being investigated in order to meet the objectives of the project.

5.1 Sampling Location Selection

The basis for determining the location of the verification samples is determined by the DQOs needed for each site being investigated. The statistical methods used to determine the sampling sites and frequency are dependent upon or influenced by each particular site being investigated.

5.2 Presampling Considerations

The ANL-W CERCLA Project Engineer will ensure that a Hazard Analysis, Safe Work Permit (SWP), ANL-W Job Specific Radiation Work Permit (RWP), and required OSHA training have been completed by the subcontractor prior to commencement of field activities. The CERCLA Project Engineer is responsible for ensuring that all information pertaining to the sampling project is recorded accurately and completely. The following sections are required to ensure that QC and Chain-of Custody (COC) procedures are properly documented.

5.3 Sample Labels

Preprinted sample labels will be used for all bottles. These sample labels will have an adhesive back with peel-off backing. The preprinted sample labels will include the following headers: sample identification number, sample location, date, time, requested analysis, and collector's initials. These labels will be filled out by the subcontractor and have sufficient space following the headers to allow the sample collectors sufficient room to complete the site specific data.

5.4 Sample Identification Numbers

A unique alpha-numeric sample identification number will be assigned to each sample container by the CERCLA Project Engineer. The number will identify the site, sample location and type of sample. All QC samples will be blind submittals to the analytical laboratory (ie. not labeled QC). The identity of the QC samples will be known only to the field crew and ANL-W CERCLA Project Engineer.

5.5 Custody Seals

Self-adhering custody seals will be placed directly over the sample lid and attached to two sides of the sample bottle. The custody seals are used to protect the integrity of the sample from sample collection to analysis by the laboratory (to gain access to the sample the custody seal would have to be destroyed). The subcontractor will be responsible for completing the custody seals. The custody seals will contain at a minimum the following information:

- Signature of the individual whom collected the sample
- Date of the sample collection
- Sample number

5.6 Logbooks

The subcontractor Field Team Leader is responsible for ensuring the project information is recorded in the appropriate logbook. All logbooks will be hard bound with consecutively numbered pages. All logbook entries will be made in permanent black ink. Every page will be dated, and signed by the individual making the entry. If an error is made on any document, corrections will be made by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated by the individual making the correction. Pages will not be removed from the logbooks, and correction fluid will not be used for any reason. Two logbooks will be used for this investigation:

- ANL-W CERCLA Project Engineer logbook
  - Dates and times of meetings, conferences, correspondence, or deliverables
  - Names of all visitors and escorts present during field activities
  - Any observations pertinent to the overall project

- Sample Number/Sample Collection/Shipping Logbook
  - Names and signatures of all field sampling team members
  - Daily record of events, observations, and measurements during sample collection
  - Qualitative description of soil (texture, color, roundness, moisture content)
  - Date of sampling/shipping activity, sample/shipping identification numbers
  - Sample collection information (any notable problems or concerns)
  - Names of all personnel present

- Field observations (sunny, windy, rainy, temperature, etc.)
- Description of sampling point including depth

5.7 Chain of Custody

The COC form is a required document used to track the samples from collection to final analysis. The form is completed by the subcontractor as the sample is collected and shipped, and will be kept with the samples at all times. It must be signed by each person taking custody of the samples. Normally this form will be signed by the sample collector, the person receiving the samples from the collector, the shipping personnel, and the laboratory receiving the samples.

5.8 Sampling and Equipment Procedures

The number and types of samples and the analysis requested for each sample will be described in the Remedial Action Work Plan. At ANL-W all collection procedures used in the EWMP section are detailed in the ANL-W Environmental Procedures Manual. Additional Standard Operating Procedures (SOPs) used may be those used at the INEEL ER group. A copy of the ANL-W Environmental Procedures Manual will be supplied upon request.

5.9 Sample Equipment Decontamination

The sampling equipment used during the collection of the samples will be decontaminated by the subcontractor prior to and after each sample is collected. The SOPs used for equipment decontamination are listed in the ANL-W Environmental Procedures Manual. A copy of the ANL-W Environmental Procedures Manual will be supplied upon request.

5.10 Sample Preservation and Holding Times

Sample preservation and holding times are sample medium and analysis specific. Tables 13 and 14 list preservation methods and holding times for those types of analysis commonly used at ANL-W. If the preservation and/or holding times are not met for a particular sample the sample will be flagged during the data validation process.

6. ANALYTICAL PROCEDURES

Prior to the selection of an analytical laboratory the following must be considered: the laboratory's status and/or certification and the laboratory's acceptance criteria regarding the radioactive content of the samples.

Once a laboratory is selected and approved by ANL-W, all samples will be analyzed utilizing EPA approved methods, American National Standards Institute (ANSI) standard methods, and ASTM or industry accepted methods.

7. CALIBRATION PROCEDURES

All laboratory analysis equipment will be calibrated in accordance to the manufacturer's recommendations which define the calibration frequency and acceptance criteria. All field equipment (radiological and environmental) used must be calibrated according to the manufacturer's recommendations. Field equipment calibration procedures must be documented in the sample log book.

8. DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the data reduction scheme for collected data, the criteria used to evaluate data integrity, the method used for handling outliers, and flow of data from collection through storage of the validated data.

8.1 Data Reduction

Data reduction occurs at two points in the data collection and interpretation process: in the laboratory and following receipt of the data. Data reduction of raw laboratory data will be performed by the laboratory after ANL-W reviews the procedures. Data reduction of the analytical data for interpretation, if required, will occur in conjunction with a statistician and will be documented in the project report.

8.2 Data Validation

Data validation is the review of measurements and analytical results to confirm that method requirements have been achieved. The primary purpose of data validation is to ensure the legal defensibility of the data. Therefore, data validation to the highest degree possible should be performed on data that may result in a final action of the site. The subcontractor will perform, at a minimum, Level C validation for screening activities and Level B and/or A for verification samples. The procedures for method data validation, including determining outliers and appropriate qualification flags, are in the ANL-W Environmental Procedures Manual.[12,13,14,15,&16]

8.3 Data Reporting

All subcontractor provided analytical packages submitted to ANL-W shall include as a minimum the following:

- Sample receipt and tracking documentation, including identification of the organization and individuals performing the analysis, the names and signatures of the responsible analyst, sample holding time requirements, references to applicable COC procedures, and the dates of sample receipt, extraction, and analysis.

- Instrument calibration documentation, including equipment type and model, with continuing calibration data for the time period in which the analysis was performed.

- Quality control data, as appropriate for the methods used, including matrix spike/matrix spike duplicate data, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that may have affected the laboratory's measurement system during the time period in which the analysis was performed.

- The analytical results or data deliverables, including a narrative summary, reduced and raw data, reduction formulas or algorithms and identification of data outliers or deficiencies.

9. INTERNAL QUALITY CONTROL CHECKS

All samples will be subject to internal QC measures for both laboratory and field analysis. ANL-W will use as a minimum the following internal quality control checks for laboratory and field analyses as identified in Section 9.1 and 9.2.

9.1 Laboratory Quality Control

Laboratory QA/QC procedures for all samples submitted by ANL-W may include performance evaluation samples (PES).

- A matrix spike is a natural sample which is fortified (spiked) with the analytes of interest and analyzed with the associated sample batch to evaluate the effects of the sample matrix on the analytical method. One matrix spike sample will be prepared for each soil matrix encountered. The matrix spike sample results will be used for the laboratory spike analysis calculations. Results from the matrix spikes will help determine how the sample effects the laboratory precision and accuracy.

9.2 Field Quality Control

Field methods of internal quality control shall be established by submitting QA/QC samples to the analytical laboratory. The types of field quality control samples are shown in Table 12 and listed below.

- Field blanks consist of water used for sample equipment decontamination within the sampling area. It is expected that deionized distilled water for decontamination purposes will be supplied by ANL-W. One field blank will be prepared for each type of matrix encountered. The field blank water will be placed in the sample container from the same lot as the other sample containers. Results from the field blank will help determine the level of contamination introduced into the sample from ambient conditions during the sampling technique.

- Field duplicates are obtained by collecting two samples at the same sampling point. One field duplicate will be randomly selected from each of the ten sample locations. The analysis of field duplicates reflects the heterogeneity of the natural sampling media. Results from the field duplicates will help determine the effects of sampling precision.

- Trip blank samples are used to detect cross contamination of volatiles during shipment. Each sample cooler containing volatiles will contain laboratory prepared volatile samples.

10. PERFORMANCE AND SYSTEMS ASSESSMENTS

Performance assessments are conducted to independently collect measurement data to determine the accuracy of portions or the accuracy of the total measurement system. System assessments are used to ensure that the QAPjP activities relating to the sampling and analysis of verification samples are performed according to the QAPjP. Performance assessments will be performed in accordance with EPA requirements for Preparing Quality Assurance Project Plans, QAM 005/80, EPA, 1980. Systems assessments are conducted according to ANL-W ESH/QA Oversight and Quality Assurance Procedures (Procedure Number III-3).

Evaluating the performance of the activities will be the responsibility of the NTD Quality Assurance Representative. System assessments will occur throughout the sampling aspect of the project, while performance assessment activities will commence shortly after the beginning of field activities. Quality-related activities will be assessed to ensure compliance with the QAPjP. Internal inspections will be performed annually for each specific activity. Significant deviations from the QAPjP will be brought to the attention of the project manager and NTD Quality Assurance Representative, and corrective actions will be taken as required by AWP 4.7 Nonconformance Reporting System. Any discrepancies noted during an assessment that cannot be immediately corrected to the satisfaction of the assessor shall be documented by report (Procedure Number III-3).

10.1 Performance Assessments

Field performance assessments shall be used to determine the status of the sampling operation. To accomplish this task, sample records, sampling equipment, and sampling operations will be assessed to ensure their compliance with the QAPjP and applicable SOPs. The data management system will be checked to ensure the correct identification of a sample from any stage of sampling to its shipment to the analytical laboratory. Laboratory performance assessment requirements will be met by the analysis of a minimum of two soil performance samples.

10.2 Systems Assessments

System assessments are performed to assess all aspects of the data production process. The purpose of the system assessment is to evaluate the organization elements of the sampling program and ensure that these elements are in compliance with the QAPjP. After the commencement of on-site activities, sample chain of custody procedures, sampling methods, and data transcriptions shall be assessed by the ANL-W Quality Engineer. This system assessment shall be an overall evaluation of the sampling project.

11. CALCULATION OF DATA QUALITY INDICATORS

The data quality indicators of precision, accuracy and completeness are addressed in Section 4, Quality Assurance Objectives for Measurements, and Section 9, Internal Quality Control Checks. The equations that will be used to calculate and report these data quality indicators that will be described in this section. The data quality indicators, which will be calculated by the subcontractor for field investigations, include precision, accuracy, and completeness. All calculations are per EPA guidance.[29]

11.1 Precision

Three calculations will be used to assess various measurements for precision. The RPD or RSD is calculated for every contaminant for which field or laboratory duplicates and/or splits exist. The precision of the absolute range (PAR) can be used when the absolute variation between two measurements is more appropriate.

The RPD is used when there are two observed values (i.e., field collocated duplicates, field splits, laboratory duplicates or laboratory matrix spike/matrix spike duplicates). The RSD is used when there are more than two observed values.

The RPD for duplicate or split samples is calculated by:

$$RPD = \frac{C_1 - C_2}{(C_1 + C_2)/2} \times 100\%$$

where: *RPD* is relative percent difference
C_1 is larger of the two observed values
C_2 is smaller of the two observed values.

The RSD for three or more observed values is calculated as follows:

$$\%\ RSD = \frac{s}{\bar{x}} \times 100$$

where: *RSD* is relative standard deviation
s is standard deviation
$\bar{x}$ is mean of observations.

The standard deviation is calculated by:

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

where: s is standard deviation
χ_i is measured value of the ith observation
$\bar{x}$ is mean of observation measurements
n is number of observations.

For measurements, such as pH, where absolute variation is more appropriate, PAR of duplicate measurements calculation can be used in lieu of the standard deviation.

PAR is calculated by:

$$D = |m_1 - m_2|$$

where: D is absolute range
m_1 is first measurement
m_2 is second measurement.

Assuming that the variances follow a chi-squared distribution, the precision obtained will be based upon the number of duplicate and/or split samples, with a confidence of 1-α as shown by:

$$\frac{ns^2}{\chi^2_{\cdot 1-(\alpha/2)}} \leq \sigma^2 \leq \frac{ns^2}{\chi^2_{\cdot(\alpha/2)}}$$

where: σ^2 is variance to be estimated
s is standard deviation
n is number of duplicate or split pairs
χ^2 is chi-squared value.

The number of duplicate and/or split samples recommended by the EPA for field QC samples is shown in Table 12.

11.2 Accuracy

Two calculations will be used to assess laboratory accuracy: percent recovered (%Rec) of the MS and %Rec of known and/or blind Laboratory Control Samples (LCS).

The %Rec of the MS is calculated by:

$$\%\ Rec = \frac{C_i - C_o}{C_t}\ x\ 100\%$$

where: *%Rec* is percent recovery
C_i is concentration of spiked aliquot
C_o is concentration of unspiked aliquot
C_t is the actual concentration of the spike added.

The %Rec of a known and/or blind LCS or a standard reference material (SRM) is calculated as:

$$\%\ Rec = \frac{C_m}{C_{srm}}\ x\ 100\%$$

where *%Rec* is percent recovery
Cm is measured concentration of the SRM or the LCS
Csrm is actual or certified amount of analyte in the sample.

11.3 Completeness

One calculation will be used to assess completeness.

Completeness is calculated by:

$$\%C = \frac{S_a}{S_t}\ x\ 100\%$$

where *%C* is percent completeness
S_a is number of samples for which acceptable data are generated
S_t is the total number of samples planned in the FSP.

12. CORRECTIVE ACTION

Corrective action procedures are implemented when samples do not meet QA/QC established standards. Two types of corrective action are discussed: field corrective action(s) and laboratory corrective actions(s).

12.1 Field Corrective Action(s)

The CERCLA Project Engineer is responsible for ensuring the field QA/QC procedures are followed. If a situation develops which may jeopardize the integrity of the samples, the CERCLA Project Engineer will document the situation, the possible impacts to the DQOs of the project, and the corrective actions taken. The CERCLA Project Engineer will notify or consult with appropriate ANL-W, EPA, and IDHW individuals.

12.2 Laboratory Corrective Action(s)

The laboratory manager is responsible for ensuring that laboratory QA/QC procedures are followed. Laboratory situations requiring corrective actions, the appropriate corrective action, and the documentation requirements will be specified in the Laboratory SOW. If notified by the laboratory of a situation that may impact the DQOs of the project, then the CERCLA Project Engineer shall notify the appropriate ANL-W, EPA, and IDHW individuals.

13. RECORD KEEPING

Records that furnish documentary evidence of quality shall be specified, prepared, and maintained. Records shall be legible, identifiable, and retrievable. Records shall be protected against damage, deterioration, or loss. The CERCLA Project Engineer shall be responsible for the control and retention of records generated during this project.

14. QUALITY ASSURANCE REPORTS

As previously noted in Section 10 of this QAPjP, the activities associated with the collection of samples in accordance with the FSP shall be routinely subjected to assessment through performance assessments and systems assessments. At the completion of the investigation the NTD Quality Assurance Representative shall summarize all such activity in a report to the CERCLA Project Engineer. The report shall identify all open action items, shall identify and analyze any adverse quality trends, and based on an evaluation of the data validation summary reports from the investigation, shall include an assessment of the overall adequacy of the total measurement system with regard to the Quality Assurance Objectives for Measurements discussed in Section 4 of this QAPjP.

15. PREVENTATIVE MAINTENANCE

Preventative maintenance items and or a list of spare parts that are required to perform the remedial action activities in a timely manner are limited to those items relating to the planting and harvesting of plants for this project. These preventative maintenance items include, the manufacturers specified lubrication frequency for the bearings and sheaves of the equipment, regular engine oil changes, air, and fuel filters for engines.

16. REFERENCES

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ATTACHMENTS

ATTACHMENT A QAPjP TABLES

Table 1. 3-90 SOW CLP Volatile Organic Target Compound List

Compound	CAS Number	CRQL			QC Limits			
		Water (μg/L)	Low Soil (μg/kg)	Med Soil (μg/kg)	Water %Rec	Water RPD	Soil %Rec	Soil RPD
Chloromethane	074-87-3	10	10	1200				
Bromomethane	74-83-9	10	10	1200				
Vinyl Chloride	75-01-4	10	10	1200				
Chloroethane	75-00-3	10	10	1200				
Methylene Chloride	75-09-2	10	10	1200				
Acetone	67-64-1	10	10	1200				
Carbon Disulfide	75-15-0	10	10	1200				
1,1-Dichloroethene	75-35-4	10	10	1200				
1,1-Dichloroethane	75-34-3	10	10	1200	61-145	14	59-172	22
1,2-Dichloroethene (total)	540-59-0	10	10	1200				
Chloroform	67-66-3	10	10	1200				
1,2-Dichloroethane	107-06-2	10	10	1200				
2-Butanone	78-93-3	10	10	1200				
1,1,1-Trichloroethane	71-55-6	10	10	1200				
Carbon Tetrachloride	56-23-5	10	10	1200				
Bromodichloromethane	75-27-4	10	10	1200				
1,2-Dichloropropene	78-87-5	10	10	1200				
cia-1,3-Dichloropropene	10061-02-6	10	10	1200				
Trichloroethene	79-01-6	10	10	1200	71-120	14	62-137	24
Dibromochloromethane	124-48-1	10	10	1200				
1,1,2-Trichloroethane	79-00-5	10	10	1200				
Benzene	71-43-2	10	10	1200	76-127	11	66-142	21
trans-1,3-Dichloropropene	10061-02-6	10	10	1200				
Bromoform	75-25-2	10	10	1200				
4,Methyl-2-Pentanone	108-10-1	10	10	1200				
2-Hexanone	594-78-6	10	10	1200				
Tetrachloroethene	127-18-4	10	10	1200				
1,1,2,2-Tetrachloroethane	79-34-5	10	10	1200				
Toluene	108-88-3	10	10	1200	76-125	13	59-139	21
Chlorobenzene	108-90-7	10	10	1200	75-130	13	59-139	21
Ethylbenzene	100-41-4	10	10	1200				
Styrene	100-42-5	10	10	1200				
Xylene (total)	1330-20-7	10	10	1200				

Table 2. 3-90 SOW CLP Semivolatile Organ Target Compound List

Compound	CAS Number	CRQL			QC Limits			
		Water (μg/L)	Low Soil (μg/kg)	Med Soil (μg/kg)	Water %Rec	Water RPD	Soil %Rec	Soil RPD
Phenol	108-95-2	10	330	10000	12-110	42	26-90	35
bis(2-Choloroethyl)ether	111-44-4	10	330	10000				
2-Chlorophenol	95-57-8	10	330	10000	27-123	40	25-102	50
1,3-Dichlorobenzene	541-73-1	10	330	10000				
1,4-Dichlorobenzene	106-46-7	10	330	10000	36-97 28	28	28-104	27
1,2-Dichlorobenzene	95-50-1	10	330	10000				
2-Methylphenol	95-48-7	10	330	10000				
2,2-oxibis(1-Chloropropane)	108-60-1	10	330	10000				
4-Methylphenol	106-44-5	10	330	10000				
N-Nitroso-di-n-propylamine	621-64-7	10	330	10000	41-116	38	41-126	38
Hexachloroethane	67-72-1	10	330	10000				
Nitrobenzene	98-95-3	10	330	10000				
Isophorone	78-59-1	10	330	10000				
2-Nitrophenol	88-75-5	10	330	10000				
2,4-Dimethylphenol	105-67-9	10	330	10000				
bis(2-Chloroethoxy)methane	111-91-1	10	330	10000				
2,4-Dichlorophenol	120-83-2	10	330	10000				
1,2,4-Trichlorobenzene	120-82-1	10	330	10000	39-98	28	38-107	23
Naphthalene	91-20-3	10	330	10000				
4-Chloroaniline	106-47-8	10	330	10000				
Hexachlorobutadiene	87-68-3	10	330	10000				
4-Chloro-3-methylphenol	59-50-7	10	330	10000	23-97	42	26-103	33
2-Methylnaphthalene	91-57-6	10	330	10000				
Hexachlorocyclopentadiene	77-47-4	10	330	10000				
2,4,6-Trichlorophenol	88-06-2	10	330	10000				
2,4,5-Trichlorophenol	95-95-4	10	1700	50000				
2-Chloronaphthalene	91-58-7	10	330	10000				
2-Nitroaniline	88-74-4	50	1700	50000				
Dimethylphthalate	131-11-3	10	330	10000				
Acenaphthylene	208-96-8	10	330	10000				
2,6-Dinitrotoluene	606-20-2	10	330	10000				
3-Nitroaniline	99-09-2	50	1700	50000				
Acenaphthene	83-32-9	10	330	10000	46-118	31	31-137	19

Table 2. 3-90 SOW CLP Semivolatile Organ Target Compound List (cont.)

Compound	CAS Number	CRQL			QC Limits			
		Water (μg/L)	Low Soil (μg/kg)	Med Soil (μg/kg)	Water %Rec	Water RPD	Soil %Rec	Soil RPD
2,4-Dinitrophenol	51-28-5	50	1700	50000				
4-Nitrophenol	100-02-7	50	1700	50000	10-80	50	11-114	50
Dibenzofuran	132-64-9	10	330	10000				
2,4-Dinitrotoluene	121-14-2	10	330	10000	24-96	38	28-89	47
Diethylphthalate	84-66-2	10	330	10000				
4-Chlorophenyl-phenylether	7005-72-3	10	330	10000				
Fluorene	86-73-7	10	330	10000				
4-Nitroanaline	100-01-6	50	1700	50000				
4,6-Dinitro-2-methylphenol	534-52-1	50	1700	50000				
N-Nitrosodiphenylamine	86-30-6	10	330	10000				
4-Bromophenyl-phenylether	101-55-3	10	330	10000				
Hexachlorobenzene	118-74-1	10	330	10000				
Pentachlorophenol	87-86-5	50	1700	50000	9-103	50	17-109	47
Phenanthrene	85-01-8	10	330	10000				
Anthracene	120-12-7	10	330	10000				
Carbazole	86-74-8	10	330	10000				
Di-n-butylphthalate	84-74-2	10	330	10000				
Fluoranthene	206-44-0	10	330	10000				
Pyrene	129-00-0	10	330	10000	26-127	31	35-142	36
Butylbenzylphthalate	85-68-7	10	330	10000				
3,3'-Dichlorobenzidine	91-94-1	10	330	10000				
Benzo(a)anthracene	56-55-3	10	330	10000				
Chrysene	218-01-9	10	330	10000				
bis(2-Ethylhexyl)phthalate	117-81-7	10	330	10000				
Di-n-octyphthalate	117-84-0	10	330	10000				
Benzo(b)fluoranthene	205-99-2	10	330	10000				
Benzo(k)fluroanthene	207-08-9	10	330	10000				
Benzo(a)pyrene	50-32-8	10	330	10000				
Indeno(1,2,3-cd)pyrene	193-39-5	10	330	10000				
Dibenz(a,h)anthracene	53-70-3	10	330	10000				
Benzo(g,h)perylene	191-24-2	10	330	10000				

Table 3. 3-90 SOW CLP Pesticide Organic Target Compound List

Compound	CAS Number	CRQL		QC Limits			
		Water (μg/L)	Soil (μg/kg)	Water %Rec	Water RPD	Soil %Rec	Soil RPD
alpha-BHC	319-84-6	0.05	1.7				
beta-BHC	319-85-7	0.05	1.7				
delta-BHC	319-86-8	0.05	1.7				
gamma-BHC (Lindane)	58-89-9	0.05	1.7	56-123	15	46-127	50
Heptachlor	76-44-8	0.05	1.7	40-131	20	35-130	31
Aldrin	309-00-2	0.05	1.7	40-120	22	34-132	43
Heptachlor epoxide	1024-57-3	0.05	1.7				
Endosulfan I	959-98-8	0.05	1.7				
Dieldrin	60-57-1	0.10	3.3	52-126	18	31-134	38
4,4'-DDE	72-55-9	0.10	3.3				
Endrin	72-20-8	0.10	3.3	56-121	21	42-139	45
Endosulfan II	33213-65-9	0.10	3.3				
4,4'-DDD	72-54-8	0.10	3.3				
Endosulfan sulfate	1031-07-8	0.10	3.3				
4,4'-DDT	50-29-3	0.10	3.3	38-127	27	23-134	50
Methyloxychlor	72-43-5	0.50	17.0				
Endrin ketone	53494-70-5	0.10	3.3				
Endrin aldehyde	7421-36-3	0.10	3.3				
alpha-Chlordane	5103-71-9	0.05	1.7				
gamma-Chlordane	5103-74-2	0.05	1.7				
Toxaphene	8001-35-2	5.0	170.0				
Aroclor-1016	12674-11-2	1.0	33.0				
Aroclor-1221	11104-28-2	2.0	67.0				
Aroclor-1232	11141-16-5	1.0	33.0				
Aroclor-1242	53469-21-6	1.0	33.0				
Aroclor-1248	12672-29-6	1.0	33.0				
Aroclor-1254	11097-69-1	1.0	33.0				
Aroclor 1260	11096-82-5	1.0	33.0				

Table 4. 3-90 SOW CLP Inorganic Target Analyte List

Analyte	CAS Number	CRDL (μg/L)
Aluminum	7429-90-5	200
Antimony	7440-36-0	60
Arsenic	7440-38-2	10
Barium	7440-39-3	200
Beryllium	7440-41-7	0.2
Cadmium	7440-43-9	5
Calcium	7440-70-2	5000
Chromium	7440-50-8	10
Cobalt	7440-48-4	50
Copper	7440-50-8	25
Iron	7439-89-6	100
Lead	7439-92-1	3
Magnesium	7439-95-4	5000
Manganese	7439-96-5	15
Mercury	7439-97-6	0.2
Nickel	7440-02-0	40
Potassium	7440-09-7	5000
Selenium	7782-49-2	5
Silver	7440-22-4	10
Sodium	7440-23-5	5000
Thallium	7440-28-0	10
Vanadium	7440-62-5	50
Zinc	7440-66-6	20
Cyanide		

Table 5. ER Radionuclide Target Isotope List

Isotope	Emission	Detection Limits	
		Soil (pCi/g)	Water (pCi/L)
H-3	β		
Mn-54	γ		
Co-60	γ		
Zn-65	γ		
Sr-90	β	0.5	1
Ru-106	γ		
Ag-108m	γ		
Ag-110m	γ		
Sb-125	γ		
Cs-134	γ		
Cs-137[a]	γ	1	10
Cr-144	γ		
Eu-152	γ		
Eu-154	γ		
Th-228	α	0.5	0.05
Th-230	α	0.5	0.05
Th-232	α	0.5	0.05
U-232	α	0.5	0.05
U-235	γ	0.5	0.05
U-238	α	0.5	0.05
Pu-238	α	0.05	0.2
Pu-239/240	α	0.05	0.2
Am-241	α/γ	0.05	0.2
Cm-242	α		
Cm-244	α		
gross α	α	10	4
gross β	β	10	4

a. All γ isotopes have a detection limit commensurate with its photon yield and energy as related to the Cs-137 detection limit.

Table 6. EPA Method 524.2 Target Analyte List

Compound	CAS Number	Method Detection Limits (μg/L)	
		Wide Bore Column	Narrow Bore column
Dichlorodifluoromethane	75-71-8	0.10	0.11
Chloromethane	74-87-3	0.13	0.05
Vinyl Chloride	75-01-4	0.17	0.04
Bromomethane	74-83-9	0.11	0.06
Chloroethane	75-00-3	0.10	0.02
1,1-Dichloroethane	75-35-4	0.12	0.05
Methylene Chloride	75-04-2	0.03	0.09
trans-1,2-Dichloroethane	156-60-5	0.06	0.03
1,1-Dichloroethene	75-34-3	0.04	0.03
2,2-Dichloropropane	590-20-7	0.35	0.05
cis-1,2-Dichloropropene	156-69-4	0.12	0.06
Chloroform	67-66-3	0.03	0.02
Bromochloromethane	74-97-5	0.04	0.07
1,1,1-Trichloroethane	71-55-6	0.08	0.04
Carbon Tetrachloride	56-23-5	0.21	0.08
1,1-Dichloropropene	563-58-6	0.10	0.02
Benzene	71-43-2	0.04	0.03
1,2-Dichloroethane	107-06-2	0.06	0.02
Trichloroethene	79-01-6	0.19	0.02
1,2-Dichloropropane	78-87-58	0.04	0.02
Bromodichloromethane	75-27-4	0.08	0.03
Dibromomethane	74-95-3	0.24	0.03
trans-1,3-Dichloropropene	10061-02-6	ND	ND
Toluene	108-88-3	0.11	0.03
cis-1,3-Dichloropropene	10061-01-5	ND	ND
1,1,2-Trichloroethane	79-00-5	0.10	0.03
Tetrachloroethene	127-18-4	0.14	0.05
1,3-Dichloropropane	142-28-9	0.04	0.04
Dibromochloromethane	124-48-1	0.05	0.07

Table 6. EPA Method 524.2 Target Analyte List (continued)

Compound	CAS Number	Method Detection Limits ($\mu g/L$)	
		Wide Bore Column	Narrow Bore column
1,2-Dibromoethane	106-93-4	0.06	0.02
Chlorobenzene	108-90-7	0.04	0.03
1,1,1,2-Tetrachloroethane	630-20-6	0.05	0.04
Ethylbenzene	100-41-4	0.06	0.03
Xylene (total meta & para)	1330-20-7	0.13	0.06
Xylene (ortho)	95-47-6	0.11	0.06
Styrene	100-42-5	0.04	0.06
Bromoform	75-25-2	0.12	0.20
Isopropylbenzene	98-82-8	0.15	0.10
1,1,2,2-Tetrachloroethane	79-34-5	0.04	0.20
Bromobenzene	108-86-1	0.03	0.11
1,2,3-Trichloropropane	96-18-4	0.32	0.03
n-Propylbenzene	103-65-1	0.04	0.06
2-Chlorotoluene	95-49-8	0.04	0.05
1,3,5-Trimethylbenzene	108-67-8	0.05	0.02
4-Chlorotoluene	106-43-4	0.06	0.05
tert-Butylbenzene	98-06-6	0.14	0.33
1,2,4-Trimethylbenzene	95-63-6	0.13	0.04
sec-Butylbenzene	135-98-8	0.13	0.12
1,3-Dichlorobenzene	541-73-1	0.12	0.05
n-Butylbenzene	104-51-8	0.11	0.03
1,2-Dichlorobenzene	95-50-1	0.03	0.05
1,2-Dibromo-3-chloropropane	96-12-8	0.26	0.05
1,2,4-Trichlorobenzene	120-82-1	0.04	0.20
Hexachlorobutadiene	87-68-3	0.11	0.04
Naphthalene	91-20-3	0.04	0.04
1,2,3-Trichlorobenzene	87-61-6	0.03	0.04

Table 7. TCLP Volatile Organic Target Compound List

Compound	CAS Number	Practical Quantitation Limits (PQLs)[2]	
		Groundwater (μg/L)	Low Soil/Sediment (μg/kg)
Benzene[3]	71-43-2	5	5
Carbon Tetrachloride	56-23-5	5	5
Chlorobenzene[3]	108-90-7	5	5
Chloroform	67-66-3	5	5
1,2-Dichloroethane	107-06-2	5	5
1,1-Dichloroethylene[3]	75-35-9	5	5
Methyl Ethyl Ketone (2-butanone)	78-93-3	100	100
Tetrachloroethylene	127-18-4	5	5
Trichloroethylene[3]	79-01-6	5	5
Vinyl Chloride	75-01-4	10	10

1. SW846 Method 8240. The PQLs for the Zero Headspace Extract, Method 1311, will vary depending on the waste type as described in footnote 2.

2. Soil PQLs are based on wet weight. Actual PQLs are matrix dependent, those listed are provide for guidance and may not always be achievable.

Other Matrices:	Factor
Water miscible liquid waste	50
High-level soil & sludges	125
Non-water miscible waste	500

PQL = (PQL for groundwater x [Factor]). For non-aqueous samples, the factor is on a wet-weight basis.

3. Precision and accuracy criteria regarding MS/MSD for these compounds are the same as those specified on the CLP table.

Table 8. TCLP Semivolatile Organic Target Compound List

Compound	CAS Number	Practical Quantitation Limits (PQLs)[2]	
		Groundwater (μg/L)	Low Soil/Sediment (μg/kg)
0-Cresol	95-48-7	10	660
(2-Methylphenol) M-Cresol	108-39-4	10	660
(3-Methylphenol) P-Cresol	106-44-5	10	ND
(4-Methylphenol) Cresol	——		660
1,4-Dichbrobenzene	106-46-7	10	660
2,4-Dinitrotoluene	121-14-2	10	660
Hexachlorobenzene	118-74-1	100	660
Hexachlorobutadiene	87-68-3	10	660
Hexachloroethane	67-72-1	10	660
Nitrobenzene	75-01-4	10	660
Pentachlorophenol	87-86-5	50	3300
Pyridine	110-86-1	ND	ND
2,4,5-Trichlorophenol	95-95-4	10	660
2,4,6-Trichlorophenol	88-06-2	10	660

1. SW846 Method 8240. The PQLs for TCLP extracts, Method 1311, will vary depending the on the waste type as described in footnote 2.

2. PQLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis, therefore, PQLs will be higher based on the % moisture in each sample. This is based on a 30-g sample and gel permeation chromatography cleanup. Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

Other Matrices	Factor
Medium-level soil and sludges by sonicator	7.5
Non-water miscible waste	75

PQL = (PQL for Groundwater x [Factor])

Table 9. TCLP Metals Target Analyte List

Analyte	CAS Number	Digestion Methods[1]		Analysis[1] Methods	RQL[2] (ppb)	Precision[3]		Accuracy[4]
		Water/Extract[5]	Solid/Soil[6]			TCLP Extract	Digestates	
Arsenic (As)	7440-38-2	3010 (3020)	3050	6010 (7060)	500	±25%	±20%	±20%
Barium (Ba)	7440-39-3	3010	3050	6010	1000	±25%	±20%	±20%
Cadmium (Cd)	7440-43-9	3010	3050	6010	100	±25%	±20%	±20%
Chromium(Cr)	7440-47-3	3010	3050	6010	500	±25%	±20%	±20%
Lead (Pb)	7439-92-1	3010 (3020)	3050	6010	500	±25%	±20%	±20%
Mercury (Hg)	7439-97-6	7470	7471	7470 (7471)	20	±25%	±20%	±20%
Selenium (Se)	7782-49-2	3010 (3020)	3050	6010 (7740)	100	±25%	±20%	±20%
Silver (Ag)	7440-22-4	3010	3050	6010	500	±25%	±20%	±20%

1. Furnace methods are included in parentheses as alternatives to the inductively coupled plasma (ICP) method 6010. Mercury methods are cold vapor atomic absorption and differ between matrices (the soil method number is in parentheses). After the TCLP extraction, CLP methods may be used for sample preparation and analyte determination.
2. RQL - Required Quantitation Limit. These levels ensure that the analytes will be detected at a 99% confidence limit. These RQLs are one order of magnitude below the regulatory action limits. Individual instrument detection limits (IDLs) must be a factor of 2 below the RQL for each analyte quantitated by that instrument.
3. Precision criteria must be satisfied for TCLP extracts and the digestates. ERD-SOW-107 defines criteria.
4. Accuracy recoveries shall be based on the post extract, pre-digestion spikes. Laboratory control samples shall also be used to asses accuracy and must recover within these limits.
5. Extract generated using TCLP Method 1311.
6. Some solid matrices require digestion/preparation methods that are not listed (e.g., city waste may require method 3040).

Table 10. TCLP Pesticides/Herbicides Target Compound List

Pesticides/Herbicides	CAS Number	MDL[1] ($\mu g/L$)
Chlordane[2]	57-74-9	0.014
2,4-D[3]	94-75-7	1.2
Endrin[2]	72-20-8	0.006
Heptachlor[2]	76-44-8	0.003
Lindane[2]	58-89-9	0.004
Methoxychlor[2]	72-43-5	1.76
Toxaphene[2]	8001-35-2	0.24
2,4,5-TP(Silvex)[3]	93-72-1	0.17

1. Method Detection Limits (MDLs) for water samples. The PQLs for other matrices are calculated as below and are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

Other Matrices:	Factor
Groundwater	10
Low-level soil by sonication with GPC cleanup	670
High-level soil and sludges by sonication	10,000
Non-water miscible waste	100,000

PQL =Method detection limit x Factor. For non-aqueous samples, the factor is on a wet-weight basis.

2. SW846 Method 8080
3. SW846 Method 8150

Table 11. Miscellaneous Analytes

Analyte	Method[1]	MDL (mg/l)[2]	Precision	Accuracy
Anions	300.0 (9056)		±20%	±25%
Bromide (Br-)		0.01	±20%	±25%
Chloride (Cl-)		0.02	±20%	±25%
Fluoride (F-)		0.005	±20%	±25%
Nitrite (NO_2)		0.004	±20%	±25%
Nitrate (NO_3)		0.002	±20%	±25%
Phosphate (O-PO_4)		0.003	±20%	±25%
Sulfate (SO_4)		0.02	±20%	±25%
TOC[3]	9060	0.05	±20%	±20%
TOX[4]	9020	0.005	±20%	±20%
Ammonia (NH_3)[5]	350.1 (350.2)		±20%	±20%
Phenolics[6]	9066	0.1	±20%	±20%
Cyanide (CN-)	9010	0.010	±20%	±20%

1. Alternative methods are enclosed in parentheses. Method 9056 for anions has not been promulgate.
2. SMO SOWs shall specify the required detection levels for the analytes based on project needs.
3. TOC = Total Organic Carbon
4. TOX = Total Organic Halogens
5. Method 350.1 (350.2); methods for chemical analysis of water and wastes, EPA/600/4-79/020.
6. Precision and accuracy target ranges were estimated from the data given in the method.

Table 12. Field QC Samples[16,17]

Sample Type	Purpose	Collection	Documentation
Duplicate	Collocated sample to evaluate sample heterogeneity	One sample per week or 10% of all field samples for VOCs and/or TCLP VOCs, whichever is greater, with a minimum of two sets per media samples.[a] For non-VOCs, a minimum of one duplicate and/or split per week or 10% (duplicates and/or splits) of all field samples, whichever is greater.	Assign separate sample number, submit blind to laboratory
Split	Discrete sample divided into subsamples to evaluate within-sample heterogeneity	One sample per week or 10% of all field samples for non-VOCs and/or non-TCLP VOCs, whichever is greater, with a minimum of two sets per media sampled.[b]	Assign separate sample number, submit blind to laboratory
Field Blank	Analyte-free water which is poured into a sample container during sampling to check cross-contamination during sample collection during shipment[c]	One per group of samples from similar area per day of sampling and/or lot number of sampling containers. Use ASTM Type-II water[d] (or equivalent) for organics and metal-free (deionized or distilled) water for inorganics.	Assign separate sample number, submit blind to laboratory if accompanying water sample
Trip Blank	Organic-free sample which accompanies shipment containing samples for VOCs to evaluate cross-contamination during shipment	One ASTM Type-II water (or equivalent) per day/cooler of VOCs water sampling and/or one laboratory-prepared soil matrix (similar to soil being sampled) per day/cooler of VOCs soil sampling[e] (one per day if VOCs are expected to be well above detection limit, one per cooler if near detection limit).	Assign separate sample number
Equipment Blank	Sample obtained by rinsing equipment following decontamination with analyte-free water to evaluate field decontamination procedures	Use ASTM Type-II water (or equivalent) for organics and metal-free (deionized or distilled) water for inorganics (or equivalents) to rinse the equipment, then pour water into the sample containers.	Assign separate sample number
Matrix Spike	Used by laboratory for calculating % recoveries	At a minimum one matrix spike per sample data group or each medium being sampled	The CLP laboratory will assign a laboratory number
Performance Evaluation Sample (PES)[f]	Samples containing known concentrations of contaminants in the CLP analyte groups to evaluate accuracy of the laboratory analytical procedures	Submitted single blind or double blind to laboratory with samples from the field, minimum of 1 PES per CLP analyte group per sampling event, if available.	Assign separate sample number

a Reference number[18]
b Reference number[19]
c Reference number[20]
d Reference number[21]
e Reference number[22]
f Reference number[23]

Table 13. Summary of Sampling Collection, Holding Time, and Preservation Requirements

ANALYSIS	SAMPLE MEDIUM	VOLUME	CONTAINER TYPE	HOLDING TIME	PRESERVATIVE
Gamma Spectroscopy-Gross α/β-Radiochemistry	Soil/Biota	16 oz	Wide Mouth Plastic Jar	Analyze within 1 year.	None
Gamma Spectroscopy-Gross α/β-Radiochemistry	Water	See Table 14			
CLP Metals	Soil	250 ml	Wide Mouth Glass Jar	Analyze within 6 months, except Hg - analyze within 28 days.	4°C
CLP Metals	Water	1000 ml	HPDE Bottle	Analyze within 6 months, except Hg - analyze within 28 days.	HNO_3 to pH<2
CLP Volatiles	Soil	125 ml	Wide Mouth Glass Jar	Analyze within 14 days.	4°C, 4 drops HCl
CLP Volatiles	Water	2 x 40 ml*	40 ml Glass Vials	Analyze within 14 days.	4°C
CLP Semivolatiles	Soil	250 ml	Wide Mouth Glass Jar	Extract within 14 days, analyze extracts within 40 days of extraction.	4°C
CLP Semivolatiles	Water	1000 ml	Amber Glass Jugs	Extract within 7 days, analyze extracts within 40 days of extraction.	4°C
Anions	Soil	250 ml	Wide Mouth Glass Jar	Analyze within 48 hours for NO_3 and PO_4. All others - 28 days.	4°C
Anions	Water	500 ml	HPDE Bottle	Analyze within 48 hours for NO_3 and PO_4. All others - 28 days.	4°C
TCLP Volatiles	Soil	250 ml	Wide Mouth Glass Jar, teflon lined cap	Extract using zero headspace extraction (ZHE) within 14 days, analyze within 14 days of the ZHE.	4°C
TCLP Metals/Semivolatiles/Pesticides/Herbicides	Soil	2000 ml	Wide Mouth Glass Jar, teflon lined cap	For metals, except Hg: 1) complete TCLP extraction within 6 months; and 2) complete DA within 6 months of TCLP extraction. For Hg: 1) complete TCLP extraction within 28 days; and 2) complete DA within 28 days of TCLP extraction. For semivolatiles, pesticides & herbicides: 1)complete TCLP extraction with 14 days; 2) complete preparative extraction (PE) within 7 days; and 3) complete determinative analysis (DA) with 40 days of the PE.	4°C
EPA Method 524.2 (Purgeable Organic Compounds)	Water	2 x 40 ml*	40 ml Glass Vial, teflon lined cap	Analyze within 14 days.	4°C, (add 25 ml ascorbic acid or drops of HCl to pH<2, as necessary)

* Once each 20 samples or 14 days, whichever comes first, 3 times the normal sample volume is required (e.g., 3000 ml instead of 1000 ml, 6 x 40 ml instead of 2 x 40 ml, etc...)

Table 14. Summary of Sampling Collection, Holding Time, and Preservation Requirements for Radiological Water Analyses

ANALYSIS	SAMPLE MEDIUM	VOLUME	CONTAINER TYPE	HOLDING TIME	PRESERVATIVE
Gamma Spectroscopy	Water	540 ml	Plastic	Analyze within 6 months.	HNO_3 to pH<2
Gross α/Gross β		1 liter[a]			HNO_3 to pH<2
Strontium		2 liters[a]			HNO_3 to pH<2
Americium-241		2 liters[a]			HNO_3 to pH<2
Plutonium Isotopes		2 liters[a]			HNO_3 to pH<2
Uranium Isotopes		2 liters[a]			HNO_3 to pH<2
Tritium		1 liter[a]			None
Gross spectrometric α[b]		540 ml			HNO_3 to pH<2

a Volumes required for these analyses may be combined into one container
b Available only at the EG&G radiochemistry laboratory

Table 15. Physical Property Measurement Methods

Measurement Parameter	Reference	Sample Condition
Saturated Hydraulic Conductivity • Constant Head Method • Falling Head Method	 MOSA[a] p.694 MOSA p. 700	Undisturbed sample
Unsaturated Hydraulic Conductivity • Mualem Method • One-Step Outflow Method	 Mualem[b] van Genuchten[c]	Undisturbed sample
Moisture Retention Characteristic Curve • Hanging Column Method • Pressure Plate Method	 MOSA p. 644 ASTM[d] D2325-68 or MOSA p.648	Undisturbed sample
Porosity	MOSA p. 444 or ASTM D4531	Undisturbed sample
Bulk Density	MOSA p. 364	Undisturbed sample
Particle Density - Pycnometer Method	MOSA p. 378	Sample may be disturbed
Particle Size Distribution • Mechanical Sieve • Hydrometer	 MOSA p. 383 or ASTM 422-63	Sample may be disturbed
Moisture Content • Gravimetric • Volumetric	 MOSA p. 503 or ASTM D2216 MOSA p.696	 Sample may be disturbed Undisturbed sample
Total Organic Carbon	MOSA, Part 2, p. 539	Sample may be disturbed but not sieved
X-Ray Diffraction	ASTM D934-80	Sieve through 35-mesh sieve
Cation Exchange Capacity	SW846[e] 9081	Sample may be disturbed but not sieved
Inorganic Carbon	MOSA, Part 2, p. 181-189	Sample may be disturbed
Iron Oxide/Hydroxide	MOSA, Part 1, p. 91-99	Sample may be disturbed

a A. Klute (ed.), *Methods of Soil Analysis*, American Society of Agronomy, Inc. and Soil Science Society of America, Inc., 1986.

b Y. Mualem, "A New Model for Predicting the Hydraulic conductivity of Unsaturated Porous Media, "*Water Resources Research*, 2, 3, 1976, pp. 513-522.

c M. van Genuchten, "a Closed-Form Equation for predicting the Hydraulic Conductivity of Unsaturated Soils," *Soil Science Society of America Journal*, 44, 1980, pp. 892-898.

d 1986 *Annual book of ASTM Standards*, American Society for Testing and Materials, 1986.

e Environmental Protection Agency, *Test Methods for evaluating Solid Waste, Physical and Chemical Methods*, SW-846, 1986.

ATTACHMENT B ANL-W ENVIRONMENTAL PROCEDURES MANUAL TOC

ANL-W ENVIRONMENTAL PROCEDURES MANUAL

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